EV2000 Series Universal Variable Speed Drive

User Manual

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Preface

Thank you for using EV2000 series Variable Speed Drive made by Emerson Network Power Co., Ltd..

EV2000 satisfies the high performance requirements by using a unique control method to achieve high torque, high accuracy and wide speed-adjusting range. Its anti-tripping function and capabilities of adapting to severe power network, temperature, humidity and dusty environment exceed those of similar product made by other companies, which improves the product's reliability noticeably;

EV2000 has integrated the general requirements, customized requirements and industrial requirements perfectly. It is a innovative product with practical PI, simple PLC, flexible input and output terminals, pulse signal input, saving parameters at stop or power outage, master/slave reference control, traverse operation, fixed length control. It provides OEM customers with high integrated, reliable, cost-effective solution;

EV2000 can satisfy the customers' requirements on low noise and EMI by using optimized PWM technology and EMC design.

This manual provides information on installation, wiring, parameter setting, trouble-shooting, and daily maintenance. To ensure the correct installation and operation of the drive, please read this manual carefully before starting the drive and keep it in a safe place.

Unpacking Inspection

Upon unpacking, please check for:

Any damage occurred during transportation;

Check whether the rated values on the nameplate of the drive are in accordance with your order.

Our product is manufactured and packed at factory with great care. If there is any error, please contact us or distributors.

The user manual is subject to change without notifying the customers due to the continuous process of product improvements.

Model Designation Rules

EV2000 -4 T 0055 G / 0075 P

Drive series

Volt	Code
220V	2
380V	4

Input volt	Code
3-phase	T

Code	Drive type
G	Fixed torque
P	Fan & pump

Code	Motor power kW
0055	5.5
0075	7.5
0110	11
0150	15
0185	18.5
0220	22
0300	30
0370	37
0450	45
0550	55
0750	75
0900	90
1100	110
1320	132
1600	160
2000	200
2200	220
2800	280

Figure A-1 Explanations of Drive Models

The nameplate is located on the right hand side of the heatsink. The contents are shown in FigureA-2. A barcode on the plastic cover also contains the information of the drive, as shown in FigureA-3.

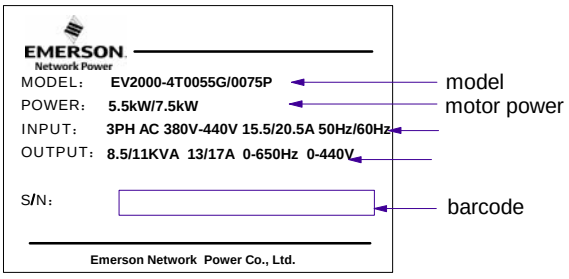


Figure A-2 Nameplate Description

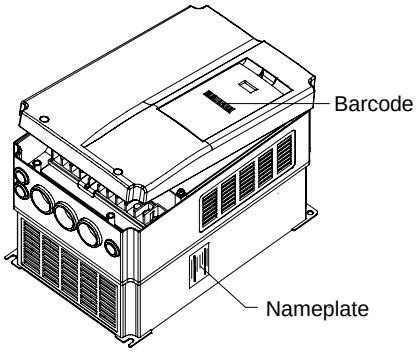


Figure A-3 Locations of Nameplate and Barcode

Chapter 1 Safety

1.1 Safety

Danger

Operations without following instructions can cause personal injury or death.

Attention

Operations without following instructions can cause personal injury or damage to product or other equipment.

1.2 Notes For Installations

Danger

- Please install the drive on fire-retardant material.
- Keep the drive away from combustible materials
- Keep the drive away from explosive gas
- Only qualified personnel shall wire the drive
- Never wire the drive unless the input AC supply is totally disconnected
- The drive must be properly earthed to reduce electrical accident
- Install the cover before switching on the drive, to reduce the danger of electric shock and explosion.
- For drives that have been stored for longer than 2 years, increase its input voltage gradually before supplying full rated input voltage to it, in order to avoid electric shock and explosion
- Don't touch the live control terminals with bare hands
- Don't operate the drive with wet hands
- Perform the maintenance job after confirming that the charging LED is off or the DC Bus voltage is below 36V.
- Only trained professionals can change the components, it is prohibited to leave wires or metal parts inside the drive so as to avoid the risk of fire.
- Parameter settings of the control board that has been changed must be revised, otherwise accidents may occur.
- The bare portions of the power cables must be bound with insulation tapes.

Attention

- Don't carry the drive by its cover. The cover cannot support the weight of the drive and may drop.
- Please install the drive on a strong support, failing which the drive may fall off.
- Don't install the drive in places where water pipes may leak onto it.
- Don't allow screws, washers and other metal foreign matters to fall inside the drive, otherwise there is a danger of fire or damage;
- Don't operate the drive if parts are not complete, otherwise there is a danger of a fire or human injury;
- Don't install the drive under direct sunshine, otherwise it may be damaged;
- Don't short circuit P1/PB and terminal (-), otherwise there is a danger of fire or the drive may be damaged.
- Cable lugs must be connected to main terminals firmly
- Don's apply supply voltage (AC 220V or higher) to control terminals except terminals TA, TB and TC.

1.3 Notes For Using EV2000

Pay attention to the following issues when using EV2000 drive.

1.3.1 About Motor And Load

Compared to the power frequency operation

EV2000 series drives are voltage type variable speed drive. The output voltage is in PWM wave with some harmonics. Therefore, temperature rise, noise and vibration of motor are higher.

Low Speed Rotating with Constant Torque

Driving a common motor at low speed for a long time, the drive's life will be reduced due to the deteriorating heat dissipation effect, so a special variable frequency motor is needed if long time operation with constant torque is required.

Motor's over-temperature protecting threshold

The drive can protect the motor from over-temperature. If the ratings of the driven motor are not in compliance with the drive, be sure to adjust the protective threshold to ensure the motor is properly protected.

Operate above 50Hz

When running the motor above 50Hz, there will be increase in vibration and noise. The rate at which the torque is available from the motor is inversely proportional to its increase in running speed. Ensure that the motor can still provide sufficient torque to the load.

Lubrication of mechanical devices

Over time, the lubricants in mechanical devices, such as gear box, geared motor, etc. when running at low speed, will deteriorate. Frequent maintenance is recommended.

Braking Torque

Braking torque is developed in the machine when the drive is hoisting a load down. The drive will trip when it cannot cope with dissipating the regenerative energy of the load. Therefore, a braking unit with proper parameters setting in the drive is required.

The mechanical resonance point of load

The drive system may encounter mechanical resonance with the load when operating within certain band of output frequency. Skip frequencies have been set to avoid it.

The drive should be started and stopped via its control terminals. It is prohibited to start and stop the drive directly through input line contactors, which may damage the drive with frequent operations.

Insulation of Motors

Before using the drive, the insulation of the motors must be checked, especially, if it is used for the first time or if it has been stored for a long time. This is to reduce the risk of the Drive from being damaged by the poor insulation of the motor. Wiring diagram is shown in Figure 1-1. Please use 500V insulation tester to measure the insulating resistance. It should not be less than 5MΩ.

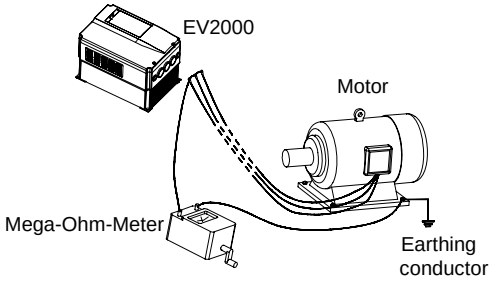


Figure 1-1 Checking the insulation of motor

1.3.2 About Variable Speed Drive

Varistors or Capacitors Used to Improve the Power Factor

Don't connect any varistor or capacitor to the output terminals of the drive, because the drive's output voltage waveform is pulse wave, otherwise tripping or damaging of components may occur; in addition, don't install circuit breaker or contactor at the output side of the drive as shown in Figure1-2.

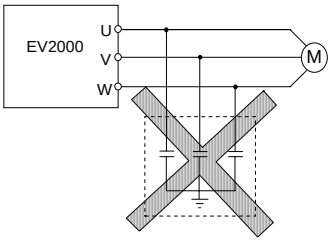


Figure 1-2 Capacitors are prohiBited to be used.

Circuit breakers connected to the output of the drive

If circuit breaker or contactor needs to be connected between the drive and the motor, be sure to operate these circuit breakers or contactor when the drive has no output, to avoid damaging of the drive.

Using outside the range of rated voltage

The drive is not suitable to be used out of the specified range of operation voltage. If needed, please use suitable voltage regulation device.

Change from 3-phase to 2-phase

It is not recommended to change the drive from 3-phase input to 2-phase input. If it is necessary to use on two phases, the phase-loss protection function of the drive should be disabled. The Drive must be derated for this operation. For motors at which power is above 30kW, if it is changed into 2-phase input, then the input phases must be at phase R and phase T, or else the drive will not work.

After the 3-phase input is changed into 2-phase input, bus-voltage and current ripple may increase, which not only influences the life of electrolytic capacitor but it also deteriorates the performance of the drive. The drive's operating current should be derated and should not exceed 67% of rated value.

Protection against lightning strike

There are transient surge suppressors inside the Drive which protects it against lighting strike.

Derating due to Altitude

Derating must be considered when the drive is installed at high altitude, greater than 1000m. This is because the cooling effect of Drive is deteriorated due to the thin air, as shown in Figure1-3 that indicates the relationship between the elevation and rated current of the Drive.

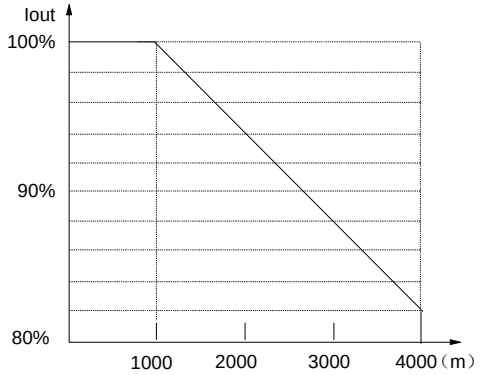


Figure 1-3 Derating Drive's output current with altitude

1.4 Disposing Unwanted Drive

When disposing the Drive, pay attention to the following factors:

The capacitors may explode when they are burnt.

Poisonous gas may be generated when the plastic parts like front covers are burnt.

Disposing method: Please dispose the Drive as industrial waste.

Chapter 2 Product Introduction

2.1 Specifications

Table 2-1 General specifications

Item		Description
Input	Rated voltage & frequency	Three-phase,380V~440V; 50Hz/60Hz
	Permissible fluctuation range	Voltage:320V~460V;Voltage unbalance rate:<3%; Frequency: ± 5%
Output	Rated voltage	380V
	Frequency	0Hz~650Hz
	Over load ability	Type G: 150% rated current for 1 minute, 200% rated current for 0.5 second; Type P: 110% rated current for 1 minute, 150% rated current for 1 second
Main control functions	Modulation mode	Flux vector PWM modulation
	Speed range	1:100
	Starting torque	180% rated torque at 0.50Hz
	Steady accuracy of speed	≤ ± 0.5% rated synchronous speed
	Accuracy of frequency	Digital setting: highest frequency×± 0.01%;analog setting: highest frequency×± 0.2%
	Setting frequency resolution	Digital setting:0.01Hz;analog setting: highest frequency×0.1%
	Torque boost	Auto torque boost, Manual torque boost0.1%~30.0%
	V/F curve	4 modes: 1 V/F curve mode set by user and 3 kinds of torque-derating modes (2.0 order, 1.7 order, and 1.2 order)
	Acc/Dec curve	3 modes: linear Acc/Dec, S ramp Acc/Dec and auto Acc/Dec; Acc/Dec time(maximum: 60 hours) and unit(second or minute) are settable.
	DC injection braking	Initial frequency of DC injection braking process: 0.20~60.00Hz, braking time: 0.0~30.0s braking current: Type G: 0.0~100.0% Type P: 0.0~80.0%
	Jog	Range of jog frequency:0.20Hz~50.00Hz; Acc/Dec time of Jog operation: 0.1~60.0s, Interval of Jog operation is also settable.
	Multi-step speed running	Multi-step speed running can be realized by internal PLC or control terminal
	Internal PI	Be able to form simple control system easily
	Auto-energy saving operation	V/F curve is optimized automatically according to the load condition to realize energy-saving operation.
	Auto voltage regulation(AVR)	When source voltage changes, the modulation rate can be adjusted automatically, so that the output voltage is unchanged.
	Auto current limiting	Operating current is limited automatically to avoid frequent tripping of the drive.
	Auto adjusting of carrier frequency	Optional function. The carrier frequency can be adjusted automatically according to the load condition.
Customized function	Traverse operation	Traverse operating function with adjustable central frequency
	Fixed-length control	The drive stops when preset fixed length is reached
	Droop control	Used in the application that several drives drive one motor.
	Tone adjusting	Adjust the tone of the operating motor
	Non-stop operation upon power failure	Uninterrupted operation can be realized by controlling the bus voltage when power failure occurs.
	Bundling function	Control mode and reference selector (for example panel input or analog VCI input) can be selected together at one time
Operating function	Methods of inputting operating commands	Commands can be input by terminals and serial ports.
	Methods of setting up frequency	Digital setting; Analog voltage/current setup; pulse frequency setup; set via serial port and different setting modes are selectable
	Auxiliary frequency reference	Realize flexible fine tuning of auxiliary frequency.
	Pulse output terminal	0~50kHz pulse signal output. Signals like frequency setting and output frequency can be output.
	Analog output terminals	2 analog outputs of 0/4~20mA and 0/2~10V(selectable). Be able to output signals like reference frequency and output frequency.

Item		Description
Operation panel	LED display	Be able to display about 20 kinds of parameters such as frequency setting, output frequency, output voltage and current, etc.
	LCD display	Optional, Chinese/English display
	Parameter copy	Fast parameter copy can be realized by using LCD panel.
	Keys locking up and function selection	Be able to lock part or all the keys. Be able to define the functions of part of the keys to avoid wrong operation.
Protection function		Phase failure protection, Over current protection; Over voltage protection; Under voltage protection; Over heat protection; overload protection
Optional parts		LCD operation panel, braking kit, remote mounted keypad, remote control cable and field bus adapter
Environment	Application environment	In-door, free from direct sunlight, dust, corrosive gas, combustible gas, oil mist, steam, water drop or salt
	Elevation	Lower than 1000m
	Ambient temperature	-10°C ~+40°C (ambient temperature is within 40°C ~50°C, deration is required)
	Humidity	Less than 95%RH, without condensation
	Vibration	Less than 5.9m/s^2 (0.6g)
	Storage temperature	-40°C ~+70°C
Structure	Protection level	IP20
	Cooling	Fan cooling
Mount modes		Mounted on the wall or inside cabinet
Efficiency		For 45kW or below: ≥ 93%, 55kW or above: ≥ 95%

2.2 Product Series

2.2.1 Ratings

Table 2-2 Variable Speed Drive series(55P or below)

Drive model (55P or below) (G: constant torque, P: Fan & pump)	Rated capacity (kVA)	Rated input current (A)	Rated output current (A)	Motor power (kW)
EV2000-4T0055G/0075P	8.5/11	15.5/20.5	13/17	5.5/7.5
EV2000-4T0075G/0110P	11/17	20.5/26	17/25	7.5/11
EV2000-4T0110G/0150P	17/21	26/35	25/32	11/15
EV2000-4T0150G/0185P	21/24	35/38.5	32/37	15/18.5
EV2000-4T0185G1/0220P1	24/30	38.5/46.5	37/45	18.5/22
EV2000-4T0220G1/0300P1	30/40	46.5/62	45/60	22/30
EV2000-4T0300G1/0370P1	40/50	62/76	60/75	30/37
EV2000-4T0370G1/0450P1	50/60	76/92	75/90	37/45
EV2000-4T0450G1/0550P1	60/72	92/113	90/110	45/55

Table 2-3 Variable Speed Drive series(55G or above)

Drive model (55G or above)		Rated capacity (kVA)	Rated input current (A)	Rated output current (A)	Motor power (kW)
Constant torque	Fan & pump				
EV2000-4T0550G	-	72	113	110	55
EV2000-4T0750G	EV2000-4T0750P	100	157	152	75
EV2000-4T0900G	EV2000-4T0900P	116	180	176	90
EV2000-4T1100G	EV2000-4T1100P	138	214	210	110
EV2000-4T1320G	EV2000-4T1320P	167	256	253	132
EV2000-4T1600G	EV2000-4T1600P	200	307	304	160
EV2000-4T2000G	EV2000-4T2000P	250	385	380	200
EV2000-4T2200G	EV2000-4T2200P	280	430	426	220
-	EV2000-4T2800P	342	525	520	280

Notes

1. Models in shady area are under development.
2. Please contact the manufacturer for models of EV2000-4T2800G and EV2000-4T3150P.

2.2.2 Parts Of Variable Speed Drive

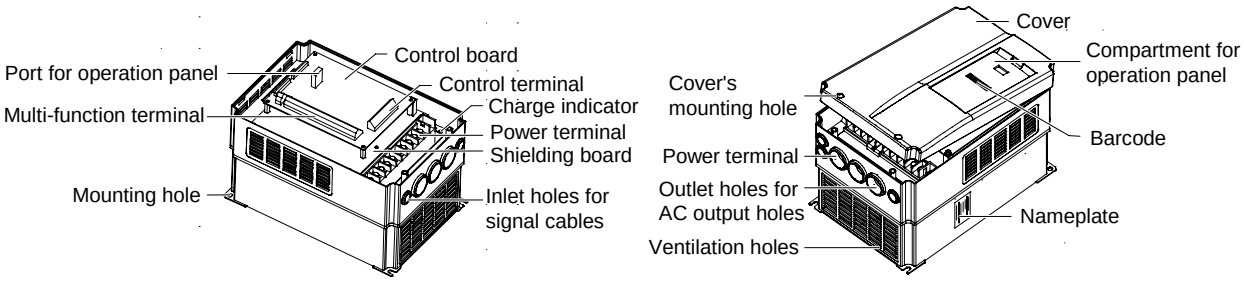


Figure 2-1 Parts of drive

2.2.3 Outline And Gross Weight

1. Outline

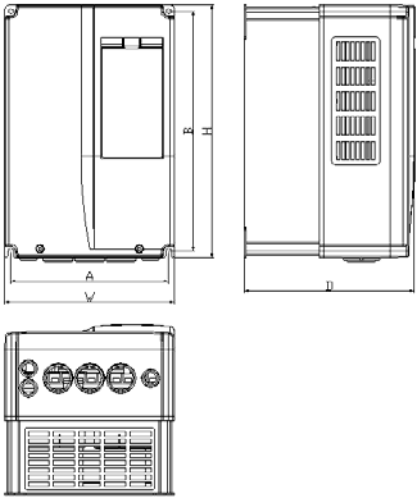


Figure a EV2000-4T0055G/0075P~ EV2000-4T0150G/0185P

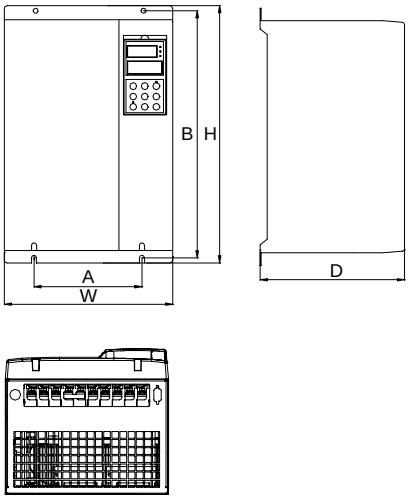


Figure b EV2000-4T0185G1/0220P1~ EV2000-4T0220G1/0300P1

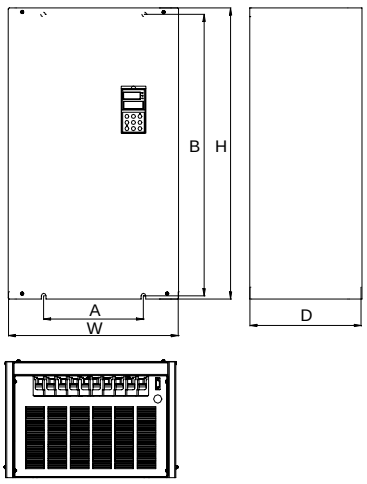


Figure c EV2000-4T0300G1/0370P1~ EV2000-4T0450G1/0550P1

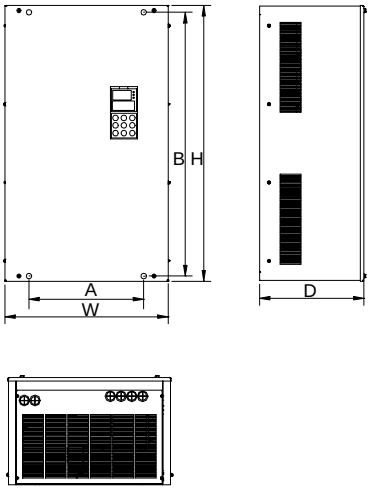


Figure d EV2000-4T0550G~ EV2000-4T01100P

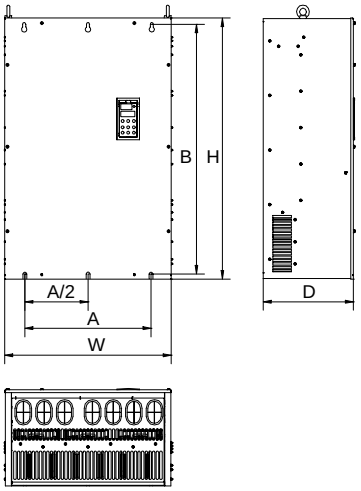


Figure e EV2000-4T01100G~ EV2000-4T2800P

Figure 2-2 Outline of EV2000

2. Mechanical parameters

Table 2-4 Mechanical parameters 1

EV2000-4T0055G/0075P~EV2000-4T0450G1/0550P1、EV2000-4T0550G、EV2000-4T0750G、EV2000-4T0750P、EV2000-4T0900P、EV2000-4T0900G、EV2000-4T1100P

Drive model (55P or below) (G: constant torque, P: Fan & pump)		Motor (kW)	A (mm)	B (mm)	H (mm)	W (mm)	D (mm)	Diameter of mounting hole(mm)	Figure Number	Gross weight(kg)
EV2000-4T0055G/0075P		5.5/7.5	186	285	300	200	202	6.8	Figure a	7.5
EV2000-4T0075G/0110P		7.5/11								
EV2000-4T0110G/0150P		11/15	236	365	380	250	209	6.8	Figure a	12
EV2000-4T0150G/0185P		15/18.5								
EV2000-4T0185G1/0220P1		18.5/22	180	421	435	275	209	7	Figure b	13
EV2000-4T0220G1/0300P1		22/30								15
EV2000-4T0300G1/0370P1		30/37	250	600	624	375	262	9	Figure b	35
EV2000-4T0370G1/0450P1		37/45								
EV2000-4T0450G1/0550P1		45/55								38
EV2000-4T0550G	_	55	300	747	770	468	301	10	Figure d	50
EV2000-4T0750G	EV2000-4T0750P	75	300	747	770	468	301	10	Figure d	50
EV2000-4T0900G	EV2000-4T0900P	90	300	747	770	468	301	10	Figure d	90
	EV2000-4T1100P	110	300	747	770	468	301	10	Figure d	90

Table 2-5 Mechanical parameters 1

EV2000-4T1100G~EV2000-4T2200G. EV2000-4T2200P. EV2000-4T2800P

Drive model		Motor (kW)	A (mm)	B (mm)	H (mm)	W (mm)	D (mm)	Diameter of mounting holes (mm)	Figure Number	Gross weight (kg)
Constant torque	Fan & pump									
EV2000-4T1100G	-	110	370	855	880	530	370	14	Figure e	100
EV2000-4T1320G	EV2000-4T1320P	132	370	855	880	530	370	14		100
EV2000-4T1600G	EV2000-4T1600P	160	370	855	880	530	370	14		100
-	EV2000-4T2000P	200	370	855	880	530	370	14		100
EV2000-4T2000G	-	200	520	975	1000	680	370	14		140
EV2000-4T2200G	EV2000-4T2200P	220	520	975	1000	680	370	14		140
-	EV2000-4T2800P	280	520	975	1000	680	370	14		140

Notes

1. Models in Table 2-5 are under developing.

2. For 75kWG drive or above, DC reactor is included in its standard configuration. The weight of DC reactor in the above table is not included in the gross weight. Outline and dimensions of DC reactor are shown below.

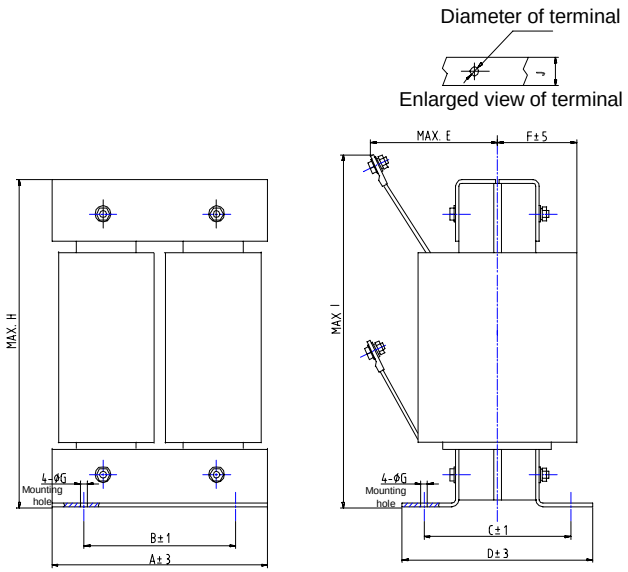


Figure 2-3 Dimensions of DC reactor

Table 2-6 Mechanical Parameters of DC Reactor

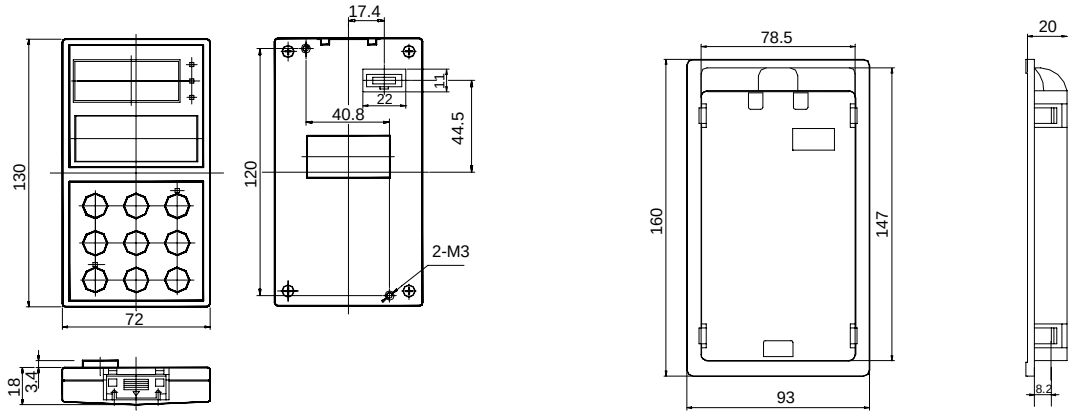
Applicable drive (kW)	Model of DC reactor	Recommended size of copper (mm^2)	Size(mm)											Gross weight (kg)
			A	B	C	D	E	F	G	H	I	J	Diameter of terminal	
75G 90G/90P	TDL-4DI01-0900	60	190	160	125	161	120	80	10	250	280	25	ϕ12	23
110G/110P	TDL-4DI01-1100	100	190	160	125	161	120	80	10	250	280	25	ϕ12	25
132G/132P	TDL-4DI01-1320	150	200	170	135	171	120	85	10	260	280	30	ϕ12	28
160G/160P	TDL-4DI01-1600	150	210	180	135	171	130	85	12	280	320	30	ϕ12	32
200G/200P	TDL-4DI01-2200	200	220	190	135	171	150	90	12	315	340	40	ϕ15	40
220G/220P		250												
280P	TDL-4DI01-2800	325	220	190	145	181	160	95	12	315	340	40	ϕ15	45

Notes

1. Columns B and C in Table 2-6 are the sizes of mounting holes of DC reactor.

2. DC reactor should be installed at the bottom of the cabinet if it is to be installed inside a cabinet. The clearance between reactor and the drive should be at least 35cm, and the reactor should be as far away from the air inlet port of the drive as possible.

3. Optional panel and mounting box



a) Operation panel *b) Mounting box (Model: EVF-KB02)*

Figure 2-4 Operation panel and mounting box

2.3 Optional Parts

All the optional parts are given below, make additional orders if needed.

2.3.1 LCD Operational Panel

Model:TDP-LCD03

Language: Chinese/English optional

LCD operation panel can perform fast parameter copy.

Interface: As shown in Figure 2-5, the interface is divided into main display area, operation instruction area and explanations for operation instructions.

Main display area: Display the status, parameters.

Operation display area: Display the next operation, if there are several operations for selection, the operation contents will be displayed in this area one by one.

Explanations for operations: Display the explanations for the "operation display area"

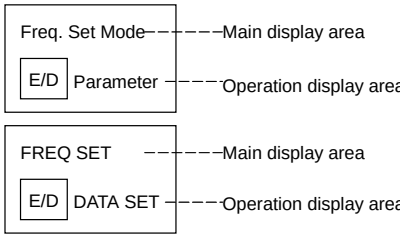


Figure 2-5 LCD display interface

2.3.2 Braking Kits

1. Braking kit

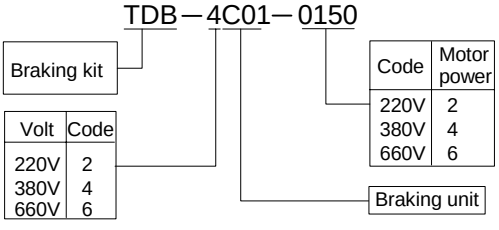


Figure 2-6 Model of braking kit

2. Braking resistor

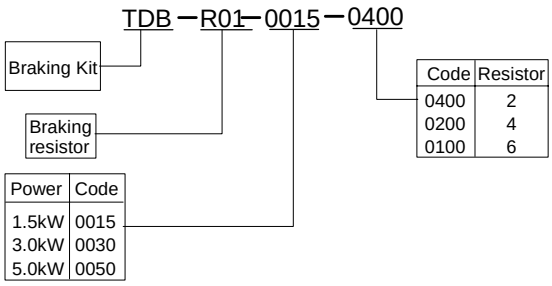


Figure 2-7 Explanations of Model of braking resistor

3. Configurations

Table 2-7 Specifications of braking kit and resistor

Rated motor power(kW)	Model of braking resistor	Ratio of working time of braking kit to drive's total working time (%)	Braking torque (%)	Maximum continuous operating time(s)	Model of braking kit
5.5	-	10	100	10	Built-in
7.5	-	10	100	10	Built-in
11	TDB-R01-0015-0400	10	100	10	TDB-4C01-0150
15	TDB-R01-0015-0400	10	100	10	TDB-4C01-0150
18.5	TDB-R01-0015-0400	10	100	10	TDB-4C01-0150
22	TDB-R01-0030-0200	10	100	10	TDB-4C01-0300
30	TDB-R01-0030-0200	10	100	10	TDB-4C01-0300
37	TDB-R01-0030-0200	10	100	10	TDB-4C01-0300
45	TDB-R01-0050-0100	10	100	10	TDB-4C01-0550
55	TDB-R01-0050-0100	10	100	10	TDB-4C01-0550
75	TDB-R01-0050-0100	10	100	10	TDB-4C01-0550

Notes

1. There is a braking kit inside the 7.5kW drive or below. An external braking resistor is needed to be connected if dynamic braking is required and the recommended resistor is 1000W/100Ω.

2. The 90kW drive or above should use several braking kits connected in parallel (TDB-4C01-0550).

4. Outline and installation sizes

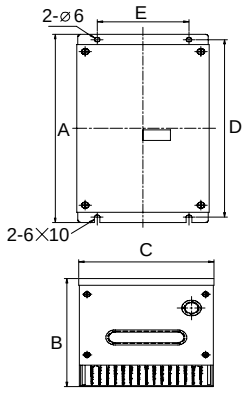


Figure 2-8 Installation dimensions of braking kit

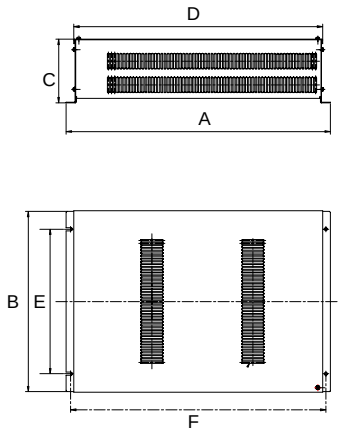


Figure 2-9 Installation dimensions of braking resistor

Table 2-8 Installation dimensions of braking kit(unit: mm)

Model of braking kit	A	B	C	D	E	Gross weight
TDB-4C01-0150	254	143	144	240	100	3 kg
TDB-4C01-0300	254	143	144	240	100	3 kg
TDB-4C01-0550	254	130	170	240	126	4 kg

Table 2-9 Installation dimensions of braking resistor

(unit: mm)

Model of braking resistor	A	B	C	D	E	F	Gross weight
TDB-4R01-0015-0400	475	228	127	447	177	460	3 kg
TDB-4R01-0030-0200	500	350	128	480	298	490	6 kg
TDB-4R01-0050-0100	540	520	170	520	470	530	8 kg

5. Functions and wiring

1) Wire connections braking resistor and braking kit

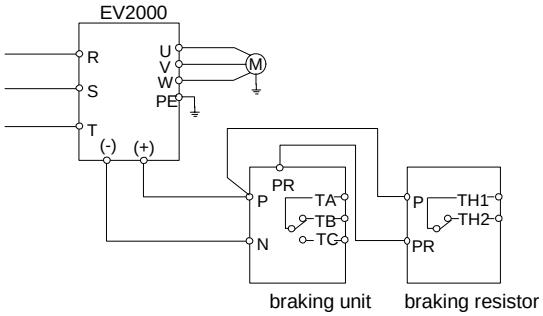


Figure 2-10 Connecting the braking kit to the Drive

TA-TB and TA-TC are contacts of relay used for outputting fault indicating signal, and TH1 and TH2 are contacts of temperature relay (relay used for outputting over-heat indicating signal).

2) Main functions of braking kit

Activation voltage for braking is adjustable;

Protection against excessive duty-cycle of braking resistor;

Overheat protection of heatsink;

Alarm indication for power module's fault;

Fault indication and indication for fault relay output;

The braking resistor will be disconnected automatically if it is over-heated and the relay will output alarming signal.

The cables connected between the braking kit and the drive, and those between the braking kit and braking resistor should be less than 5m. If longer than 5m, twisted-pair cable should be used and the maximum length is 10m.

2.3.3 Communication Parts

1. Communication cables

A. Cables of operation panel

Model: TDC-CB0015(1.5m)

TDC-CB0030(3.0m)

The cables are used to connect the panel to the drive.

B. Communication cables of remote mounted keypad

Two models: FRC21W1(3.0m) FRC21W2(30m)

The cables are used to connect the remote mounted keypad to the drive.

2. Remote mounted keypad

Model: EVO-RC03

It uses the same structure with operation panel of the drive. It is easily to be installed and secured and convenient for hand-held operation. Its display is similar to the operation panel.

RS485 communication mode is used between the drive and the remote mounted keypad. A 4-core cable is used to connect the drive and the keypad, and the maximum distance can be 1000m. Master/slave communication mode is used. The keypad is the master and the drive is the slave. Cable terminals can be secured by common screws, which makes it convenient for maintenance. One remote mounted keypad can control several drives by connecting the communication cables of 485+ and 485- of each drive to form a RS485 network.

Functions:

1) Be able to control the start, stop, jog operation, fault reset of slave drives and change the frequency settings and operation direction.

2) Identify the type of slave machine automatically. Be able to monitor the operating frequency, frequency setting, output voltage and current, analog close-loop feedback, analog close-loop setting and external counting value automatically.

3) Manage drive's parameters.

3. Fieldbus adapter

Model: TDS-PA01

Be able to connect drive to PROFIBUS network via the TDS-PA01 fieldbus adapter. In the PROFIBUS network system, the drive operates as a slave.

Functions:

1) To send control commands to drive (such as: start, stop and jog);

2) To send speed or frequency reference signal to the drive;

3) To read operating status information and actual values from the drive;

4) To reset the drive when fault occurs in it.

5) To Manage drive's parameters.

4. Keypad Holder

Model: EVF-KB02

Chapter 3 Installation And Wiring

3.1 Installation Environment

Please mount the drive vertically inside a well-ventilated location.

When selecting mounting environment, the following issues should be taken into account:

Ambient temperature should be within the range of -10°C ~40°C. If the temperature is higher than 40 °C, the drive should be derated and forced ventilation is required;

Humidity should be lower than 95% non-condensing

Mount in the location where vibration is less than 5.9m/s^2 (0.6G);

Mount in the location free of direct sunlight, dust, metal powder, corrosive gas or combustible gas.

If there are any special requirements for installation, please contact us for clarifications.

The requirements on mounting space and clearance are shown in Figure 3-1 and Figure 3-2.

When two Variable Speed Drives are mounted one on top the other, an air flow diverting plate should be fixed in between as shown in Figure 3-3.

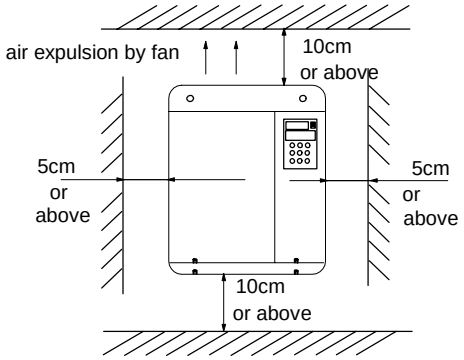


Figure 3-1 Installation clearance (45kW or below)

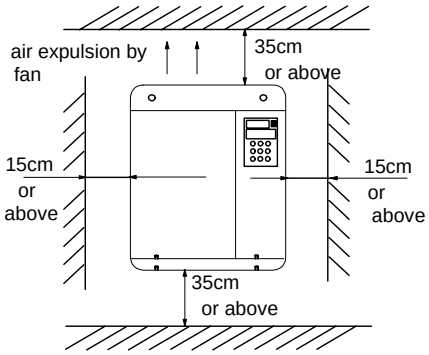


Figure 3-2 Installation clearance(55kW or above)

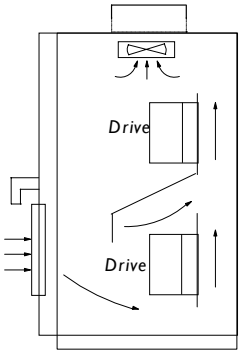


Figure 3-3 Installation of several drives

3.2 Removing And Mounting

3.2.1 Operation Panel

1. Disassembly

Put your middle finger into the hole on the top of operation panel, press down the snapper and pull the panel outward as shown in. Figure 3-4.

2. Installation

Place the bottom edge of the operation panel at the hooks of the mounting groove and press down the snapper with your middle finger. Then press the panel inward to snap it in position as shown in Figure 3-4.

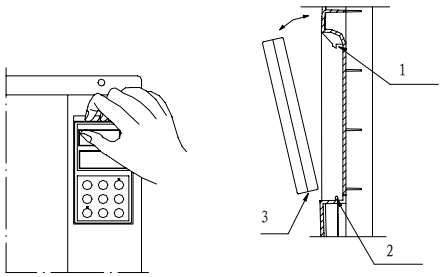


Figure 3-4 Removing and Mounting of Operation Panel

Where: 1&2: holding clamp 3:panel

3.2.2 Cover

EV2000 series have two kinds of cover, plastic or metallic one. Follow the steps below to remove and mount the cover.

1. Removing and mounting of plastic covers

1) Removing:

① Remove the operation panel

② Remove two screws at bottom

③ Lift the bottom of cover up to 5~10 degrees, move it upward at least 10mm until the clamp are out of the slot on the cabinet, then remove the front panel.

2) Mounting of plastic cover:

①Tilt the cover 5~10 degree;

②Insert the top clamp into the slot at the top of the drive;

③Mount the screws at the bottom part of the cover;

④Install the operation panel

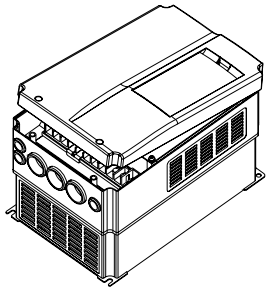


Figure 3-5 Removing and installation of plastic cover

Note

Pull out or insert the plastic cover gently, otherwise the mounting clamp may be damaged.

2. Procedures of removing and mounting the metal cover

1) Procedures of removing the metal cover:

①Remove the operational panel;

②Remove all the screws on the cover;

③Take out the cover horizontally.

2) Procedures of installing the metal cover:

①Mount the cover on the frame by screws;

②Install the operation panel.

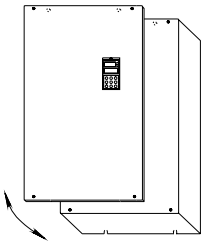


Figure 3-6 Removing and mounting metal cover

3.3 Wire Connections

Danger

- Wiring can only be done after the drive's AC power is disconnected, all the LEDs on the operation panel are off and waiting for at least 5 minutes. Then, you can remove the panel.
- Wiring job can only be done after confirming the charge indicator on the right bottom has extinguished and the voltage between main circuit power terminals + and - is below DC36V.
- Wire connections can only be done by trained and authorized personnel.
- Check the wiring carefully before connecting emergency stopping or safety circuits.
- Check the drive's voltage level before supplying power to it, otherwise human injuries or equipment damage may happen.

Attention

- Check whether the Variable Speed Drive's rated input voltage is in compliant with the AC supply voltage before using.
- Dielectric strength test of the drive has been done in factory, so you need not do it again.
- Refer to chapter 2 on connected braking resistor or braking kit.
- It is prohibited to connect the AC supply cables to the drive's terminals U, V and W.
- Grounding cables should be copper cables with section area bigger than 3.5mm^2, and the grounding resistance should be less than 10Ω.
- There is leakage current inside the drive. The total leakage current is greater than 3.5mA, depending on the usage conditions. To ensure safety, both the drive and the motor should be grounded, and a leakage current protector (RCD) should be installed. It is recommended to choose B type RCD and set the leakage current at 300mA.
- The drive should be connected to the AC supply via a circuit breaker or fuse to provide input over-current protection or convenience for disconnecting the AC supply to maintain the drive.

Wire the drive according to Figure 3-7 during commissioning :

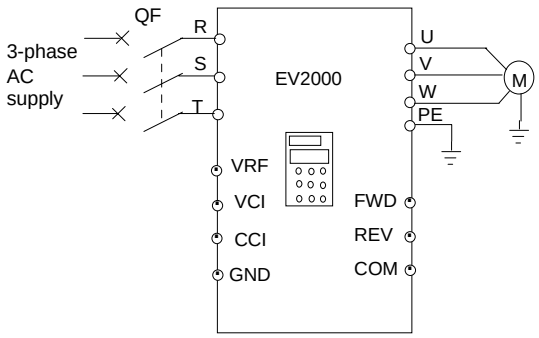


Figure 3-7 Wiring

3.3.1 Main Terminals

1. Connection between drive and optional parts

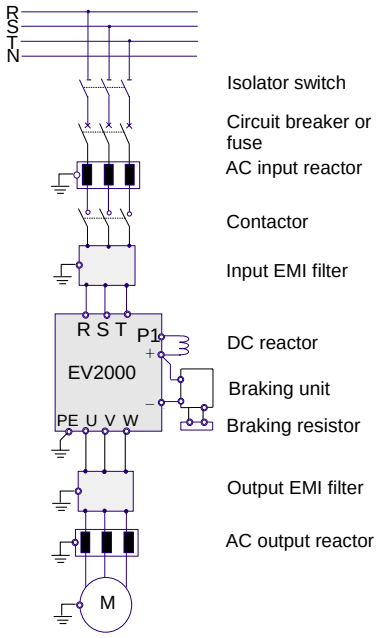


Figure 3-8 Wire connection between the drive and optional parts

1). Isolation switch should be connected between the AC supply and the drive to ensure the safety of the maintenance engineer.

2). Circuit breaker (QF) or fuse should be connected between the AC supply and the drive to isolate the fault of other equipment. Refer to Table 3-1 for the selection of circuit breaker.

Note

Parameters in the table are recommended values

3) When a contactor is used for controlling the AC supply, don't use it to switch on or off the Variable Speed Drive.

Table 3-1 Recommended capacity of circuit breaker and the cross sectional area of copper cable

Model EV2000-4T		Input switch	Main circuit (mm^2)		Control circuit (mm^2)
		Circuit breaker QF (A)	Input cable	Output cable	Control terminal
0055G/0075P		32	4	4	1
0075G/0110P		40	6	6	1
0110G/0150P		63	6	6	1
0150G/0185P		63	6	6	1
0185G/0220P		100	10	10	1
0220G/0300P		100	16	16	1
0300G/0370P		125	25	25	1
0370G/0450P		160	25	25	1
0450G/0550P		200	35	35	1
0550G		200	35	35	1
0750G	0750P	250	70	70	1
0900G	0900P	315	70	70	1
1100G	1100P	400	95	95	1
1320G	1320P	400	150	150	1
1600G	1600P	630	185	185	1
2000G	2000P	630	240	240	1
2200G	2200P	800	150×2	150×2	1
2800P		1000	185×2	185×2	1

4) DC reactor

DC reactor is required for the drive whose power is greater than EV2000-4T0750G, for the drive whose power is lower than EV2000-4T0750P, it is optional.

Under following conditions, a DC reactor should be used to reduce the impact of AC supply to the drive and to protect the drive and suppress the high-order harmonics.

(1) If a capacitor tank used for reactive power compensation or a SCR load shares the same AC supply with the drive, the harmonics caused by the SCR load or the capacitor tank when it is switched on or off may damage the drive's input rectifying circuit;

(2) When the unbalance rate of 3-phase AC supply of the drive is greater than 3%;

(3) If the input power factor of the drive is required to be greater than 0.93;

(4) When a large capacity transformer is connected to the drive, the input current of the drive may damage the rectifying circuit. Generally, if the input AC supply capacity of the drive is above 550KVA, or if the input AC supply capacity is 10 times that of the drive, a DC reactor is required to connect to the drive.

(5) Input AC Line Reactor

A line reactor should be used if the distortion of power network is severe or the input current harmonic level is high even after a DC reactor has been connected to the drive. It can also be used to improve the AC input power factor of the drive.

6) Output AC Line Reactor

When the cables from the drive to motor are longer than 80m, multi-stranded cables and an AC line reactor should be used to suppress the high frequency harmonics. Thus, the motor insulation is protected against heat due to harmonics, leakage current is reduced and the drive will not trip frequently.

(7) Input EMI filter

An EMI filter can be used to suppress the high frequency noise generated by the drive's power cables.

(8) Output EMI filter

An EMI filter can be used to suppress the drive's output noise and leakage current of cables.

(9) Safety ground

Since there is leakage current inside the drive, to ensue safety, both the drive and the motor should be grounded,

the grounding resistance should be less than 10Ω. The ground wire should be as short as possible. Please refer to the section of the earth wire in Table 3-2.

Table 3-2 Section of Ground Wire

Cable Section (mm^2)	Min. section of ground wire Sp(mm^2)
S≤ 16	S
16< S≤ 35	16
35< S	S/2

Note that the data in the above table apply when the conductor connected with the ground wire are made of the same metal, otherwise, please calculate the equivalent section based on the conductivity.

Notes:

1. EV2000 drive can meet the requirements of IEC 61800-3 after EMI filter is installed.

2. Installation of input and output EMI filters must be as close to the drive as possible. Refer to Section 3.4 of Chapter 3 for EMC installation instructions.

3. Refer to Section 2.3 of Chapter 2 and Appendix 2 for the technical parameters of optional parts.

2. Wire Connections of Drive for Basic Operation

Models: EV2000-4T0055G/0075P. EV2000-4T0075G/0110P

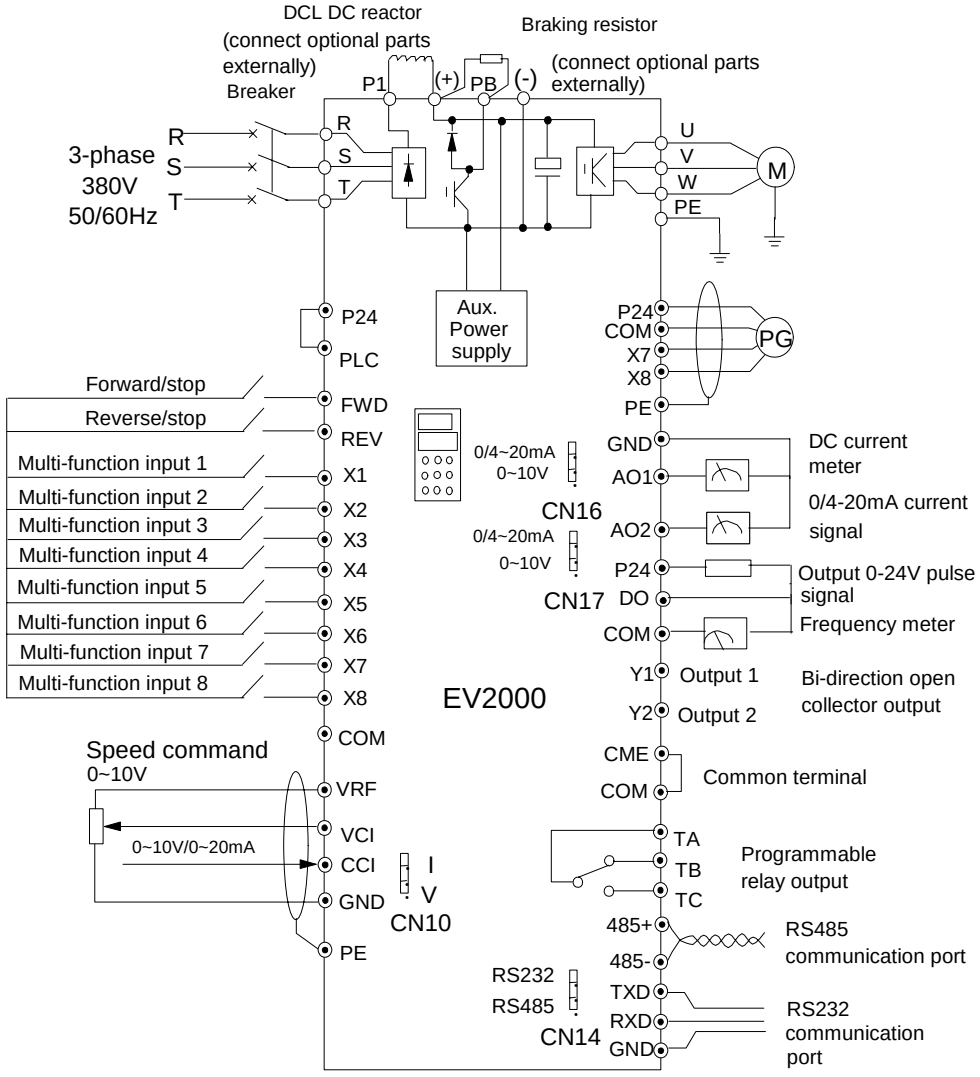


Figure 3-9 Basic wiring 1

Notes

1. Terminal CCI can be input voltage or current signal by switching the jumper CN10 on control board;

2. The auxiliary power supply comes from the bus (+) and bus (-);

3. Built-in braking kit is installed and a braking resistor is required to be connected between (+) and PB;

4. In the above figure, "O" is the terminal in main circuit, and "⊙" is the control terminal;

5. Refer to section 3.3.2 for the using of control terminals.

Applicable models: EV2000-4T0110G/0150P~EV2000-4T2800P

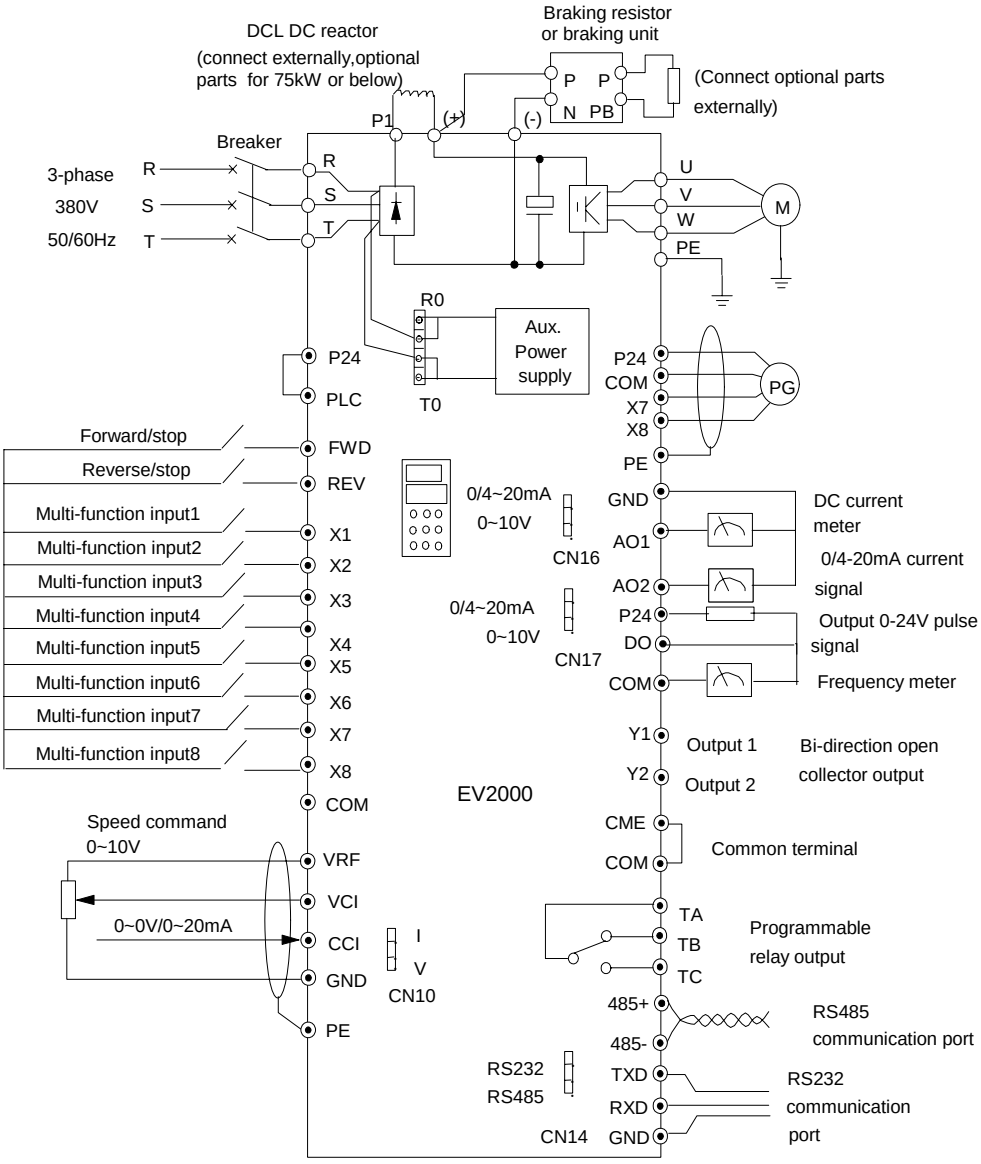


Figure 3-10 Basic wiring 2

Note

1. Terminal CCI can be input voltage or current signal by switching the jumper CN10 on control board;

2. The auxiliary power supply's AC supply comes from R0 and T0 which are shorted with R and T of 3-phase input. If you want to use an external AC supply, the shorting bars between R and R0, T and T0 have to be removed before connecting the external AC supply via R0 and T0. Otherwise, short-circuit will occur.

3. It is prohibited to connect to the control power supply without disconnecting the short-circuit bar, so as to avoid short-circuit accident;

4. If external braking parts are needed, then braking kit and braking resistors should be included; Pay attention to the polarity of the braking kit when wiring;

5. In the above figure, "O" is the terminal in main circuit, and "⊙" is the control terminal;

6. Refer to section 3.3.2 for the using of control terminals.

Applicable models: EV2000-4T0185G1/0220P1~EV2000-4T0450G1/0550P1

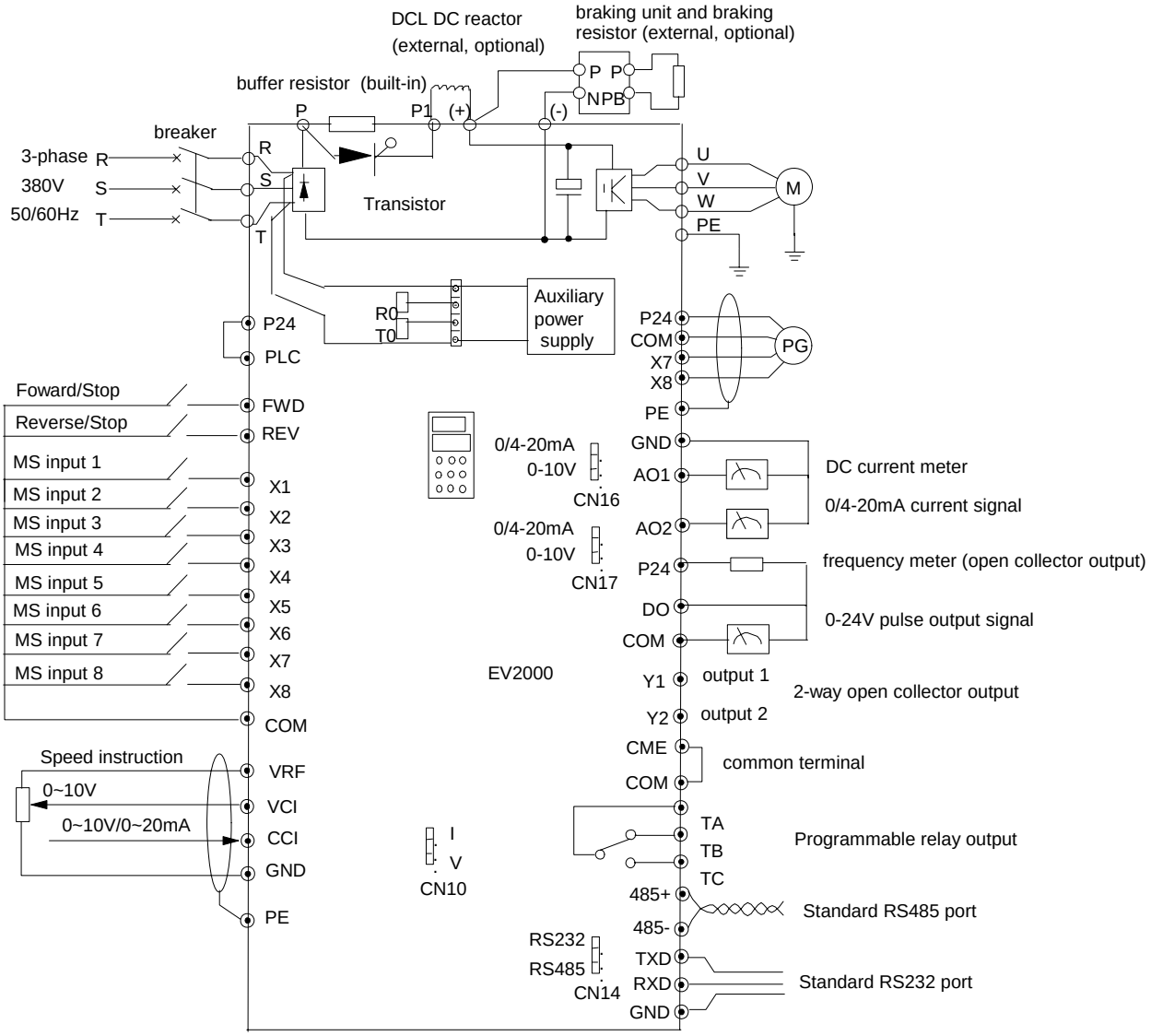


Figure 3-11 Basic Wiring 3

Note

1. Terminal CCI can be input voltage or current signal by switching the jumper CN10 on control board;

2. The auxiliary power supply of EV2000-4T0185G1/0220P1~EV2000-4T0220G1/0300P1 is from bus (+) and (-)。

3. The auxiliary power supply of EV2000-4T0300G1/0370P1~EV2000-4T0450G1/0550P1 is from R and T. If you want to use an external AC supply, the jumper on CN4 should be connected to CN3 first, and then connect it to R0 and T0.

4. If external braking kit, the braking unit and braking resistors should be included; Pay attention to the polarity of the braking kit when wiring;

5. In the above figure, "O" is the terminal in main circuit, and "⊙" is the control terminal;

6. Refer to section 3.3.2 for the usage of control terminals.

3. Input/Output Terminals in Main Circuit

1) Applicable models:

EV2000-4T0055G/0075P~EV2000-4T0150G/0185P

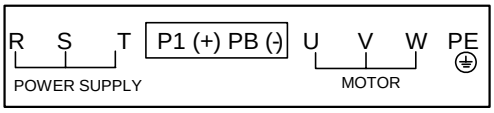


Table 3-2 Terminals of main circuit

Terminals	Function
R, S, T	3-phase 380V AC supply input terminals
P1, (+)	Reserved terminals for DC reactor, connected with copper bar before delivery.
(+), PB	Reserved terminals for braking resistor
(-)	Output terminal for DC Minus Bus
U, V, W	3-phase AC output terminals
PE	Earth terminal

Note

Terminals PB of EV2000-4T0110G/0150P and EV2000-4T0150G/0185P are suspended.

2) Applicable models:

EV2000-4T0185G/0220P~EV2000-4T0450G/0550P

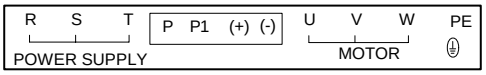


Table 3-3 Terminals of main circuit

Terminals	Function
R. S. T	3-phase 380V AC supply input terminals
P	Positive pole of the rectifying bridge
P1, (+)	Reserved terminals for DC reactor, connected by copper bar before delivery
(-)	Output terminal for DC Minus Bus
U. V. W	3-phase AC output terminals
PE	Earth terminal

3) Applicable models:

EV2000-4T0550G. EV2000-4T0750P

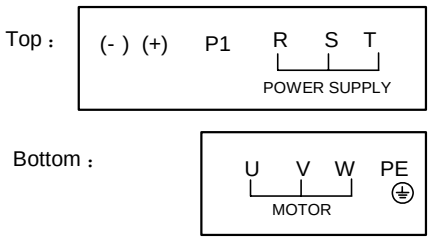


Table 3-4 Terminals of main circuit

Terminal	Function
R, S, T	3-phase 380V AC supply input terminals
P1, (+)	Reserved terminals for DC reactor
(-)	Output terminal for DC Minus Bus
U, V, W	3-phase AC output terminals
PE	Earth terminal

4) Applicable models:

EV2000-4T0750G~EV2000-4T2200G

EV2000-4T0900P~EV2000-4T2800P

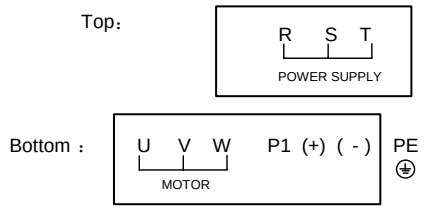


Table 3-5 Terminals of main circuit

Terminals	Function
R. S. T	3-phase 380V AC supply input terminals
P1. (+)	Reserved terminals for DC reactor
(-)	Output terminal for DC Minus Bus
U. V. W	3-phase AC output terminals
PE	Earth terminal

3.3.2 Control Circuit

1. Terminals and jumpers of control board

Locations of terminals CN5, CN6 and CN7 and jumpers CN10, CN14, CN16 and CN17 are shown in Figure 3-.

Terminal functions are given in Table 3-6. Refer to table 3-7 for the functions and settings of jumpers. Wire the terminals and set the jumpers correctly before using the Drive. It is recommended to use cables bigger than 1mm^2 to connect to the terminals.

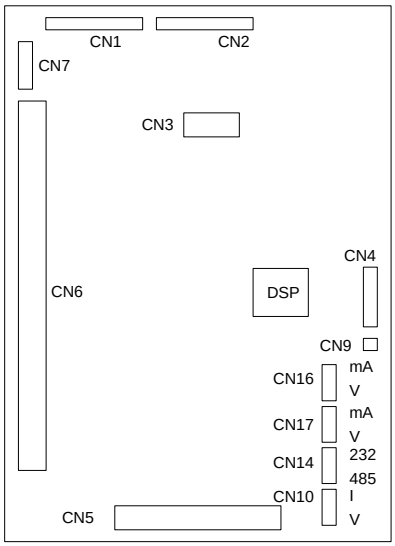


Figure 3-12 Locations of jumpers on the control board

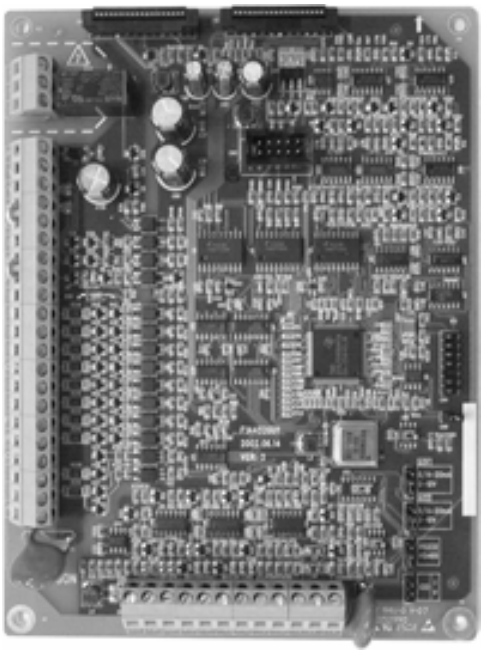


Figure 3-13 Control board

Table 3-6 Functions of terminals provided to users

SN	Function
CN5	Analog input and output terminal, RS232 and RSRS485 communication port
CN6	Digital input/output terminal
CN7	Relay output terminal

Table 3-7 Functions of jumpers provided to users

SN	Function and settings	Factory settings
CN10	Used for selecting CCI current/voltage input I: 0/4~20mA current signal, V: 0~10V voltage signal	0~10V
CN14	Used for selecting communication ports (RS232 or RS485) RS232: Select RS232 port, RS485: Select RSRS485 port	RS485
CN16	Used for selecting the output signal (current or voltage) of analog output terminal AO1; 0/4~20mA: AO1 output current signal; 0~10V: A01 output voltage signal	0~10V
CN17	Used for selecting the output signal (current or voltage) of analog output terminal AO2; 0/4~20mA: AO2 output current signal; 0~10V: AO2 output voltage signal	0~10V

2. Wire connections of terminals on control board

1) Terminal CN5 on control board

Arrangements of terminals of CN5:

VRF	VCI	CCI	GND	AO1	AO2	GND	TXD	RXD	485+	485-	PE

Functions of terminals of CN5 are given in Table 3-8.

Table 3-8 Functions of the terminals

Category	Terminals	Name	Function		Specification
Communication	RS485+	RS485 communication port	RS485 +	RS232/RS485 can be selected by jumper CN14, RS485 mode is the default mode.	Standard RS-485 communication port, please use twisted-pair cable or shielded cable.
	RS485-		RS485 -		
	TXD	RS232 communication port	Transmitting pin (Reference ground: GND)		Standard RS232 communication port, 3-wire connection (only use TXD, RXD and GND). Maximum distance: 15m
	RXD		Receiving pin (reference ground: GND)		
Analog input	VCI	Analog input VCI	Be able to accept analog voltage input (Reference ground: GND)		Input voltage range:0~10V (input resistance:100kΩ) Resolution: 1/2000
Analog input	CCI	Analog input CCI	Be able to accept analog voltage/current input. Jumper CN10 can select voltage or current input mode, Voltage input mode is the default mode.(reference ground: GND)		Input voltage range:0~10V(input resistance:100kΩ) Input current range:0~20mA (input resistance:500Ω) Resolution: 1/2000
Analog output	AO1	Analog output 1	Be able to output analog voltage/current (total 12 kinds of signals). Jumper CN16 can select voltage or current input mode, Voltage input mode is the default mode. Refer to F7.26 for details. (reference ground: GND)		Output current range: 0/4~20mA Output voltage range:0/2~10V
	AO2	Analog output 2	Be able to output analog voltage/current (total 12 kinds of signals). Jumper CN17 can select voltage or current input mode, Voltage input mode is the default mode. Refer to F7.27 for details.(reference ground: GND)		
Power supply	VRF	+10V power supply	Provide +10V power supply		Maximum output current is 50mA
	GND	GND of +10V power supply	Reference ground of analog signal and 10V power supply		Isolated with COM and CME
Shielding layer	PE	GND of shielding layer	Terminal used for the earthing the shielding layer. The shielding layers of analog signal cable, RS485 communication cable and motor cable can be connected to the terminal.		Connected to PE inside the drive.

1. Wiring analog input terminal

①VCI can accept analog voltage signal input and wiring is shown below:

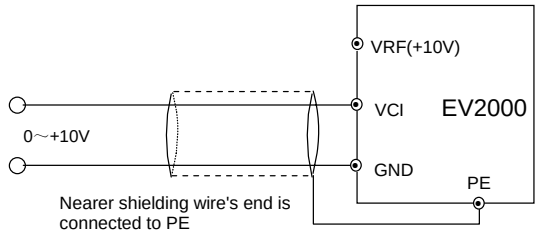


Figure 3-14 Wiring terminal VCI

②CCI can accept analog signal input and the jumper can be used to select voltage input (0~10V) and current input (0/4~20mA). The wiring is shown below:

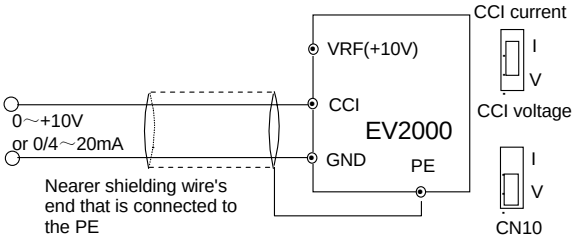


Figure 3-15 Wiring CCI

2. Wiring connections analog output terminal

If the analog output terminals AO1 and AO2 are connected to analog meters, then various kinds of physical values can be indicated. The jumper can select current output (0/4~20mA) and voltage output(0/2~10V). The wiring is shown in Figure3-16..

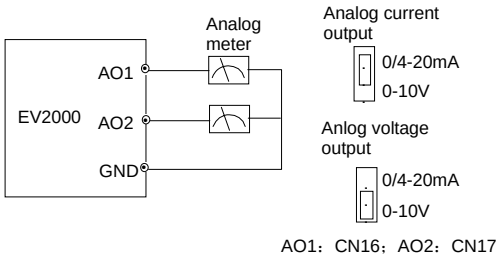


Figure 3-16 Wiring analog output terminal

Note

1. When using analog input, a common mode inductor can be installed between VCI and GND or CCI and GND.

2. Analog input and output signals are easily disturbed by noise, so shielded cables must be used to transmit these signals and the cable length should be as short as possible.

3. Wiring of Serial Communication Port

Wire connections of serial communication port.

EV2000 drive provides two kinds of serial ports: RS232 and RS485 which can be selected by Jumper CN14.

Wire as following figures show, and a “single-master single slave” system or a “single-master multi-slaves” system can be formed. The drives in the network can be monitored and controlled remotely and automatically in real time by using a PC or PLC controller. Thus more complicated operation control can be realized (e.g. Unlimited multi-step PLC operation). ① The drive connects to the host via its RS232 port:

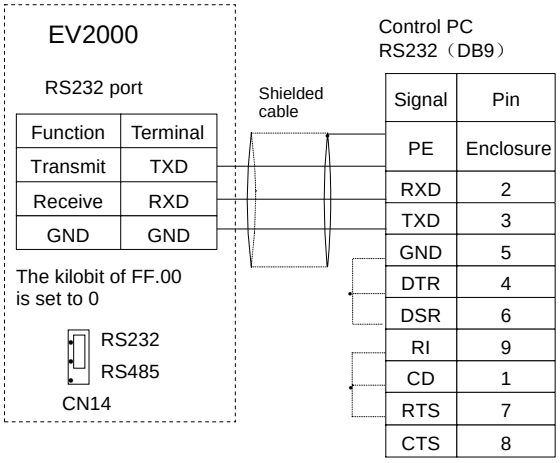


Figure 3-17 RS232-RS232 communication cables

② Connection between the drive’s RS485 port and the host PC:

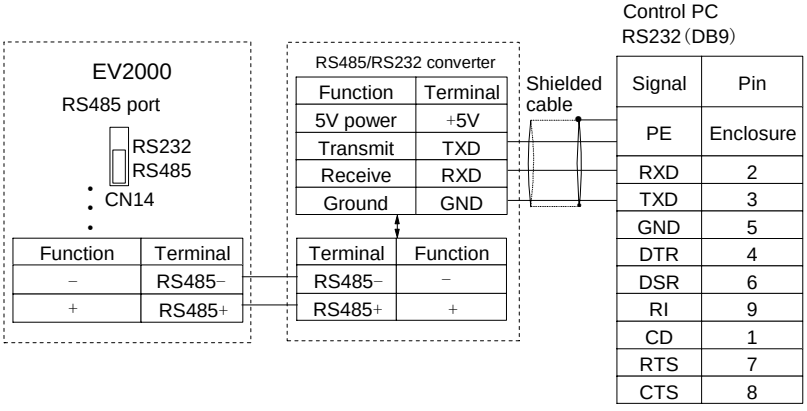


Figure 3-18 RS485-(RS485/RS232)-RS232 communication cable

③ Connect the drive to the host PC via a MODEM:

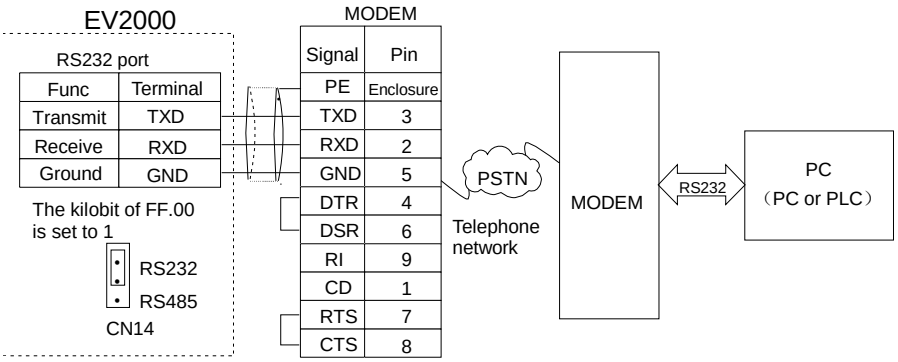


Figure 3-19 Wiring of RS232-(MODEM-PSTN-MODEM)-RS232 communication

④The drive's RS485 port connects to PROFIBUS via the TDS-PA01(field bus made by ENPC):

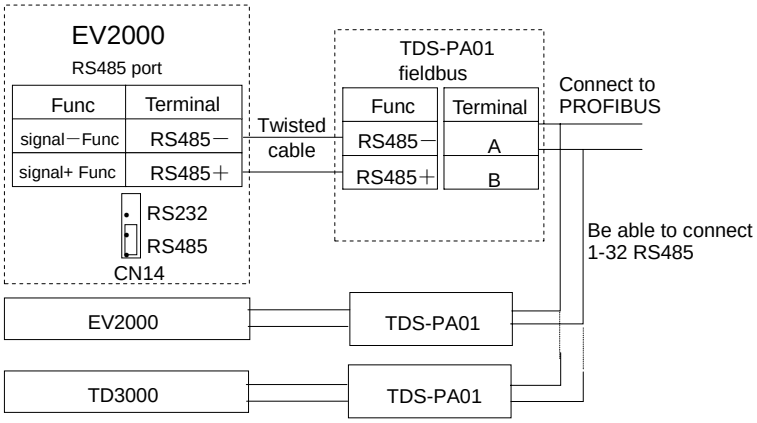


Figure 3-20 Wire connections of RS485-(TDS-PA01)-PROFIBUS communication

If several drives are connected in the network via RS485, the disturbance to the communication system increases, so the wiring is especially important, you can connect the cables according to the figure below:

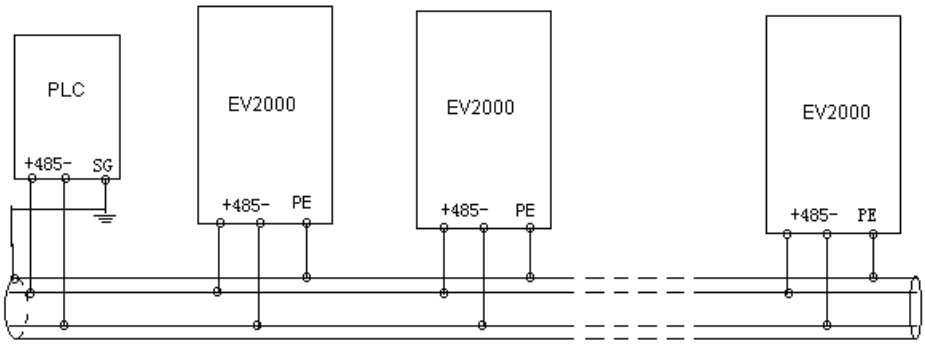


Figure 3-21 Communication between PLC and the drive (the drive and motor are grounded well)

If the communication is still abnormal, then the following actions can be taken:

① Feed a separate AC supply to the PLC(or host PC) and isolate the AC supply;

② If RS485/RS232 conversion module is used, then the module should be powered by a separate power supply;

③ Mount magnetic core to the communication cable, reduce the carrier frequency if the field conditions permit.

2). Description of control terminals CN6 and CN7

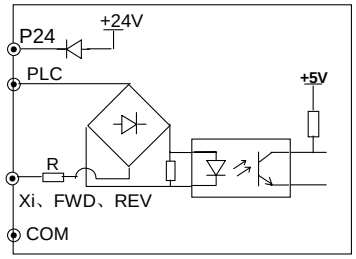
Layout of CN6:

P24	Y1	Y2	CME	COM	DO	P24	PLC	X1	X2	X3	X4	COM	X5	X6	FWD	REV	COM	X7	X8	PE

Layout of CN7:

TA	TB	TC

Table 3-9 Functions of terminals of CN6 and CN7

Category	Terminal	Name	Functions	Specifications
Operation control terminals	FWD	Terminal for inputting run forward operation command	See the explanations of F7 parameters for the commands of run forward and run reverse (common terminal: PLC)	Optical-isolator input input resistance: R＝2kΩ Maximum input frequency:200Hz Input voltage range: 9~30V
	REV	Terminal for inputting run reverse operation command		
Multi-function input terminal	X1	Multi -function input terminal 1	See section 5.8 Chapter 8 for the programmable multi-function digital input terminal (Common terminal: PLC)	
	X2	Multi -function input terminal 2		
	X3	Multi -function input terminal 3		
	X4	Multi -function input terminal 4		
	X5	Multi -function input terminal 5		
	X6	Multi -function input terminal 6		
	X7	Multi -function input terminal 7	Terminals X7 and X8 can be used as common multi-function terminals (same with X1~X6), they can also be used as high speed pulse input port. See section 5.8 Chapter 8 for details. (Common terminal: PLC)	Equivalent circuit of optical-isolator input is shown above. input resistance: R＝2kΩ Max input frequency:100kHz(single phase)/50kHz(dual phase) Input voltage range: 15~30V
	X8	Multi -function input terminal 8		
Multi-function output terminal	Y1	Open collector output terminal 1	Multi-function digital output terminal can be defined. See section 5.8 Chapter 5 for details. (Common terminal: CME)	Optical-isolator output Operating voltage range:9~30V Max output current: 50mA Refer to the explanations of F7.10~F7.11 for the using methods.
	Y2	Open collector output terminal 2		
Multi-function output terminal	DO	Open collector pulse output terminal	Multi-function pulse signal output terminal can be defined. See section 5.8 Chapter 5 for details. (Reference ground: COM)	Output frequency range: dependent on F7.32, and the Max frequency is 50kHz
Relay's output terminals	TA	Output terminals of relay	Multi-function relay output terminal can be defined. See section 5.8 Chapter 5 for details.	TA-TB: normally closed, TA-TC: normally open Capacity of contacts: AC250V/2A(COSΦ=1) AC250V/1A(COSΦ=0.4),DC30V/1A Refer to the explanations of F7.12 for the using methods.
	TB			
	TC			
Power supply	P24	+24V power supply	Provide +24V power supply for external equipment.	Maximum output current: 200mA
	PLC	Common terminal of multi-function input terminal	Common terminal of multi-function input terminal (short circuit with P24)	Common terminal of X1~X8., FWD and REV. PLC is isolated with P24.
	COM	Common terminal of +24V power supply	Total 3 common terminals, which are used in conjunction with other terminals.	COM is isolated with CME and GND.
	CME	Common terminal of Y1 and Y2 output	Common terminal of multi-function Y1 and Y2 output (Short circuit with COM by manufacturer)	
Shielding	PE	Shielded GND	Grounding terminal connected to shielding layer	Connected to PE inside the drive

1) Wire connections multi-function input terminals, terminals FWD and REV:

EV2000 multi-function input terminal uses a full-bridge rectifying circuit as shown in Figure 3-. PLC is the common terminal of terminals X1~X8, FWD and REV. The current flows through terminal PLC can be pulling current, and also the feeding current. Wire connections X1~X8, FWD and REV is flexible and the typical wiring is shown below:

A) Method 1 of connections (Dry contacts)

①If internal 24V power supply is used, the wiring is shown in Figure 3-22.

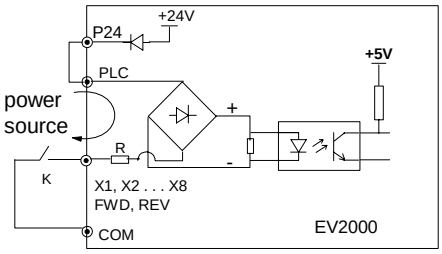


Figure 3-22 Using internal 24V power supply

②If an external power supply is used, then use the Wire connections shown in Figure 3-23. (be sure to disconnect the cable between P24 and PLC)

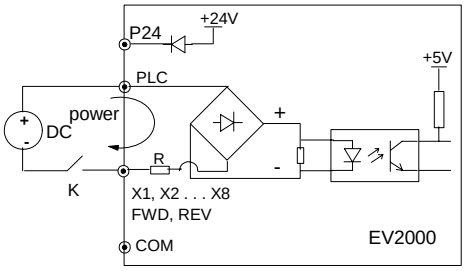


Figure 3-23 Using an external supply

B). Method 2 of connections

①Drive's internal +24V power supply is used and the external controller uses NPN transistors whose common emitters are connected, as shown in Figure 3-24.

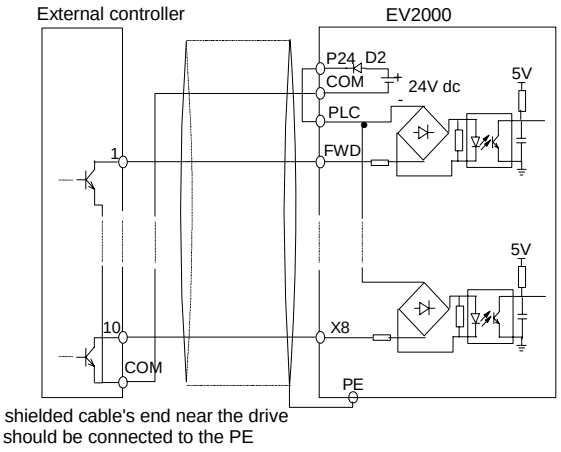


Figure 3-24 Method 2 of connections(a)

②Drive's internal +24V power supply is used and the external controller uses PNP transistors whose common emitters are connected, as shown in Figure 3-25

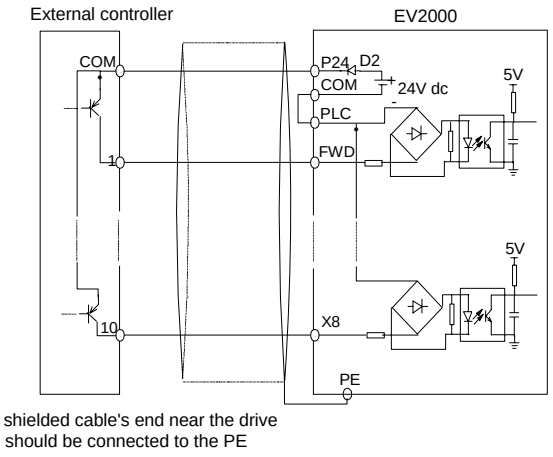


Figure 3-25 Method 2 of connections(b)

③Use external power supply:

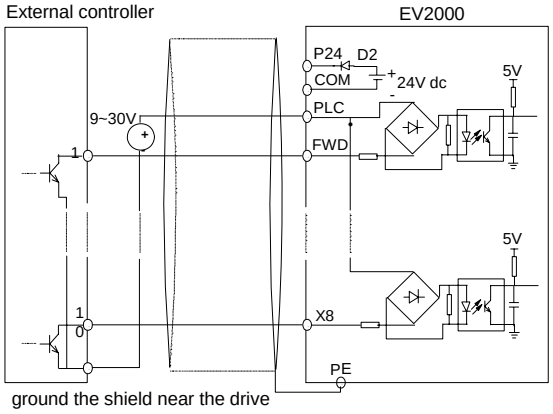


Figure 3-26 Method 2 of connections(c)

④Use external power supply:

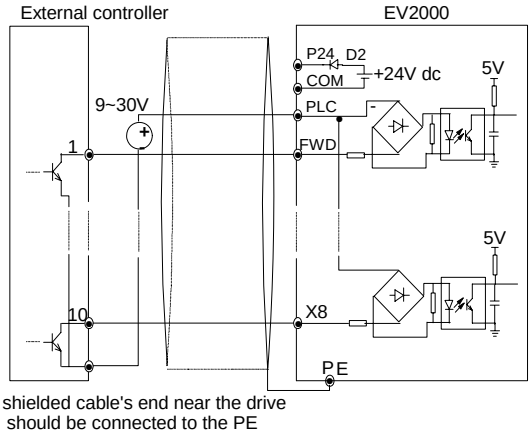


Figure 3-27 Method 2 of connections (d)

2) Wire connections of multi-function output terminal

①Multi-function output terminals Y1 and Y2 can use the 24V power supply inside the drive and the wiring mode is shown in Figure 3-28..

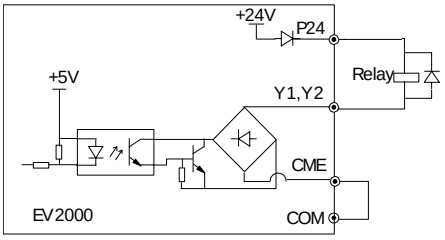


Figure 3-28 Wire connections 1 of multi-function output terminal

②Multi-function output terminals Y1 and Y2 can also use the 9~30V power supply outside the drive and the wiring mode is shown in Figure3-29.

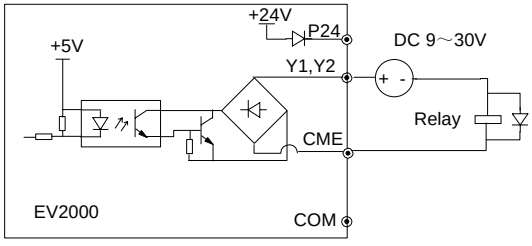


Figure 3-29 Wire connections 2 of multi-function output terminal

③Pulse output terminal DO can use the 24V power supply inside the drive and the wiring is shown in Figure3-30.

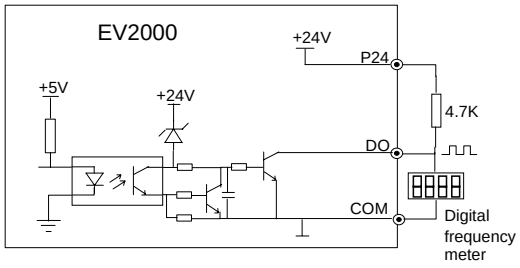


Figure 3-30 Wiring 1 of output terminal DO

④Pulse output terminal DO can also use the external 9~30V power supply and the wiring is shown in Figure3-31.

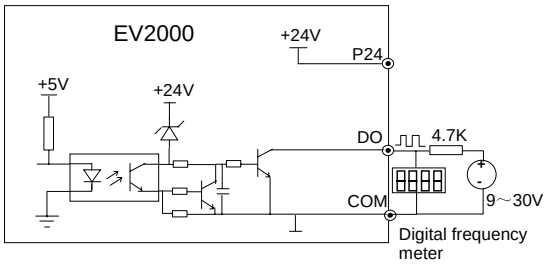


Figure 3-31 Wiring 2 of output terminal DO

3) Wiring relay output terminals TA, TB and TC.

If the drive drives an inductive load (such as relay or contactor), then a surge suppressing circuit should be added, such as RC snub circuit (pay attention that the leakage current must be smaller than the holding current of the controlled relay or contactor) and varistor or a free-wheeling diode (used in the DC electric-magnetic circuit and pay attention to the polarity during installation). Snubbing components should be as close to the coils of relay or contactor as possible.

Note

1. Don't short circuit terminals P24 and COM, otherwise the control board may be damaged.

2. Please use multi-core shielded cable or multi-stranded cable(above 1mm) to connect the control terminals.

3. When using a shielded cable, the shielded layer's end that is nearer to the drive should be connected to PE.

4. The control cables should be as far away(at least 20cm) from the main circuits and high voltage cables as possible (including power supply cables, motor cables, relay cables and cables of contactor). The cables should be vertical to each other to reduce the disturbance to minimum.

5. The resistors R in Figure 3-27 and Figure3-28 should be removed for 24V input relays, and the resistance of R should be selected according the parameters of relay for non-24V relay.

3.4 EMC Compliant Installation

The drive inevitably generates noise due to its high switching frequency, so relevant EMC problems must be solved so as to reduce the drive's disturbance to external equipment. This chapter deals with the installation methods compliant with EMC requirements from the aspects of noise suppression, field wiring, grounding, leakage current and the using of power filter. This chapter can be used as a reference for field installation.

3.4.1 Noise Suppressing

The noise generated by the drive may disturb the equipment nearby. The degree of disturbance is dependent on the drive system, immunity of the equipment, wiring, installation clearance and earthing methods.

1. Noise categories

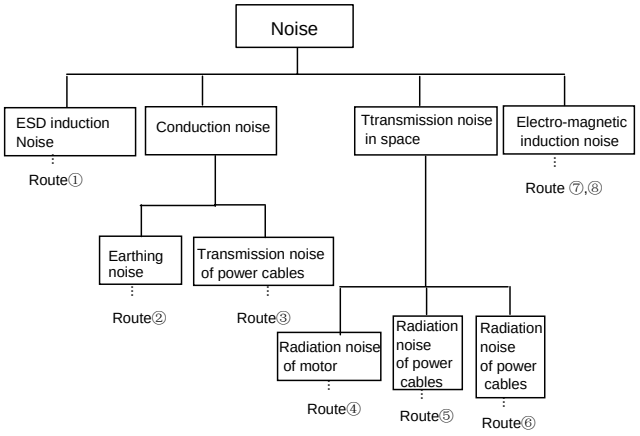


Figure 3-32 Noise categories

2. Noise propagation paths

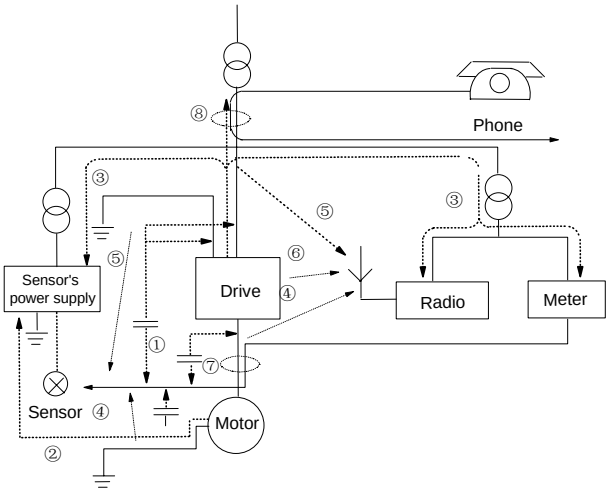


Figure 3-33 Noise transmission paths

3. Basic methods of suppressing the noise

Table 3-10 Basic methods of suppressing the noise

Noise emission paths	Actions to reduce the noise
②	When the external equipment forms a loop with the drive, the equipment may suffer nuisance tripping due to the drive's earth leakage current. The problem can be solved if the equipment is not grounded.
③	If the external equipment shares the same AC supply with the drive, the drive's noise may be transmitted

Noise emission paths	Actions to reduce the noise
	along its input power supply cables, which may cause nuisance tripping to other external equipment. Take the following actions to solve this problem: Install noise filter at the input side of the drive, and use an isolation transformer or line filter to prevent the noise from disturbing the external equipment.
④⑤⑥	If the signal cables of measuring meters, radio equipment and sensors are installed in a cabinet together with the drive, these equipment cables will be easily disturbed. Take the actions below to solve the problem: 1)The equipment and the signal cables should be as far away as possible from the drive. The signal cables should be shielded and the shielding layer should be grounded. The signal cables should be placed inside a metal tube and should be located as far away as possible from the input/output cables of the drive. If the signal cables must cross over the power cables, they should be placed at right angle to one another. 2) Install radio noise filter and linear noise filter (ferrite common-mode choke) at the input and output of the drive to suppress the emission noise of power lines. 3) Motor cables should be placed in a tube thicker than 2mm or buried in a cement conduit. Power cables should be placed inside a metal tube and be grounded by shielding layer (Motor cable should be a 4-core cable, where one core should be connected to the PE of the drive and another should be connected to the motor's enclosure).
①⑦⑧	Don't route the signal cables in parallel with the power cables or bundle these cables together because the induced electro-magnetic noise and induced ESD noise may disturb the signal cables. Other equipment should also be located as far away as possible from the drive. The signal cables should be placed inside a metal tube and should be placed as far away as possible from the input/output cables of the drive. The signal cables and power cables should be shielded cables. EMC interference will be further reduced if they could be placed inside metal tubes. The clearance between the metal tubes should be at least 20cm.

3.4.2 Field Wire Connections

Control cables, input power cables and motor cables should be installed separately, and enough clearance should be left among the cables, especially when the cables are laid in parallel and the cable length is big. If the signal cables must go through the power cables, they should be vertical to each other.

The motor cables should be derated if they are too long or their cross sectional area (CSA) is too big. The drive's cables should be the cables with specified CSA (See Table 3-1) because the capacitance of the cable to ground is in proportional to the cable's CSA. If the cable with big CSA is used, its current should be reduced.

Shielded/armoured cable: High frequency low impedance shielded cable should be used. For example: Copper net, aluminum net or iron net.

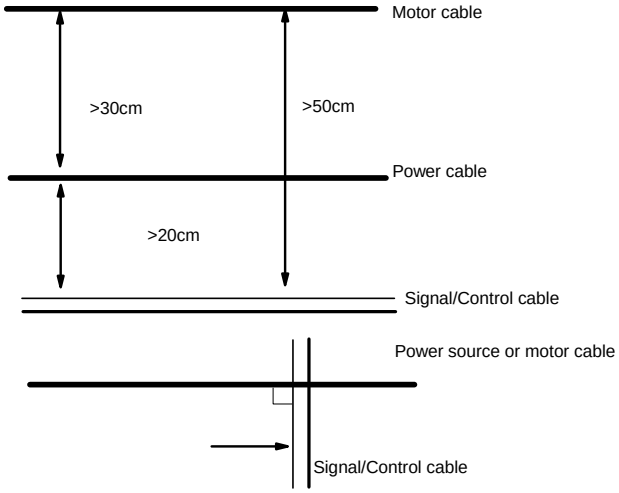


Figure 3-34 Wire connections

Generally, the control cables should be shielded cables and the shielding metal net must be connected to the metal enclosure of the drive by cable clamps.

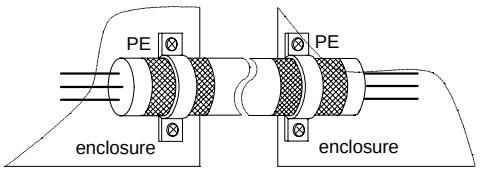


Figure 3-35 Correct shielding method of shielding layer

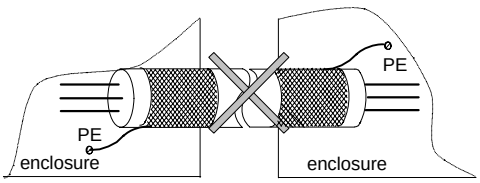


Figure 3-36 Incorrect earthing method of shielding layer

3.4.3 Earthing

Independent earthing poles (best)

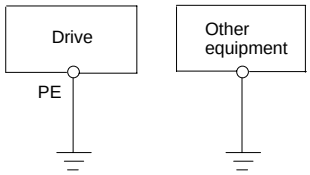


Figure 3-37 Earthing diagram 1

Shared earthing pole (good)

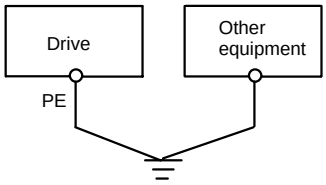


Figure 3-38 Earthing diagram 2

Shared earthing cable(not good)

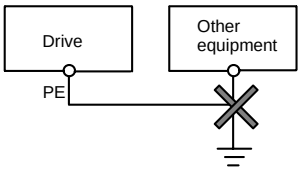


Figure 3-39 Earthing diagram 3

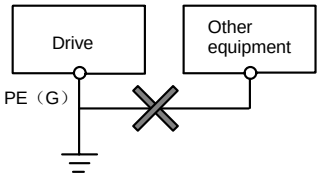


Figure 3-40 Earthing diagram 4

Besides, pay attention to the following points:

In order to reduce the earthing resistance, flat cable should be used because the high frequency impedance of flat cable is smaller than that of round cable with the same CSA.

For 4-core motor cable, the end of one cable should be connected to the PE of the drive, and the other end should be connected to the motor's enclosure. If the motor and the drive each has its own earthing pole, then the earthing effect is better.

If the earthing poles of different equipment in one system are connected together, then the leakage current will be a noise source that may disturb the whole system. Therefore, the drive's earthing pole should be separated with the earthing pole of other equipment such as audio equipment, sensors and PC, etc.

In order to reduce the high frequency impedance, the bolts used for fixing the equipment can be used as the high frequency terminal. The paints on the bolt should be cleaned.

The earthing cable should be as short as possible, that is, the earthing point should be as close to the drive as possible.

Earthing cables should be as far away from the I/O cables of the equipment that is sensitive to noise, and also should be as short as possible.

3.4.4 Relay, Contact & Electro-magnetic Braking Kit

The devices such as relay, contactor and electro-magnetic braking kit, which may generate great noises, should be installed outside of the drive cabinet and should be installed with surge suppressors.

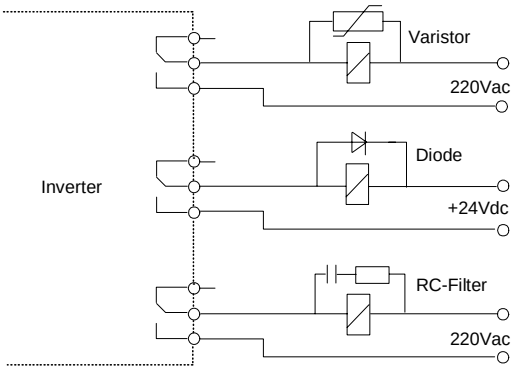


Figure 3-41 Relay, contactor and electro-magnetic braking kit

3.4.5 Leakage Current

Leakage current may flow through the drive's input and output capacitors and the motor's capacitor. The leakage current value is dependent on the distributed capacitance and carrier wave frequency. The leakage current includes ground leakage current and the leakage current between lines.

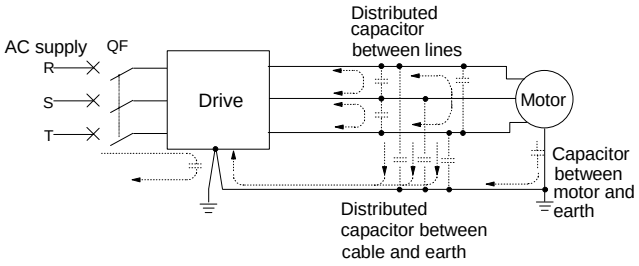


Figure 3-42 Flowing path of leakage current

Ground leakage current

The ground leakage current can not only flow into the drive system, but also other equipment via earthing cables. It may cause the leakage current circuit breaker and relays falsely activated. The higher the drive's carrier wave frequency, the bigger the leakage current, also, the longer the motor cable, the greater the leakage current,

Suppressing methods:

Reduce the carrier wave frequency, but the motor noise may be louder;

Motor cables should be as short as possible;

The drive and other equipment should use leakage current circuit breaker designed for protecting the product against high-order harmonics/surge leakage current;

Leakage current between lines

The line leakage current flowing through the distribution capacitors of the drive out side may cause the thermal relay falsely activated, especially for the drive whose power is lower than 7.5kW. When the cable is longer than 50m, the ratio of leakage current to motor rated current may be increased that can cause the wrong action of external thermal relay very easily.

Suppressing methods:

Reduce the carrier wave frequency, but the motor noise may become louder;

Install reactor at the output side of the drive.

In order to protect the motor reliably, it is recommended to use a temperature sensor to detect the motor's temperature, and use the drive's over-load protection device(electronic thermal relay) instead of an external thermal relay.

3.4.6 Correct EMC Installation

Divide the installation space into different areas

In driving system, the drive, control equipment and sensors are installed in the same cabinet, the noise should be suppressed at the main connecting points with the RFI filter and input reactor installed in cabinet to satisfy the EMC requirements.

The most effective but expensive measure to reduce the interference is to isolate the noise source and the noise receiver, which should be considered in mechanical/system design phase. In driving system, the noise source can be drive, brake unit and contactor. Noise receiver can be automation equipment, coder and sensor.

The mechanical/system is divided into different EMC area according to its electrical characteristics. The recommended installation positions are shown in the following figure:

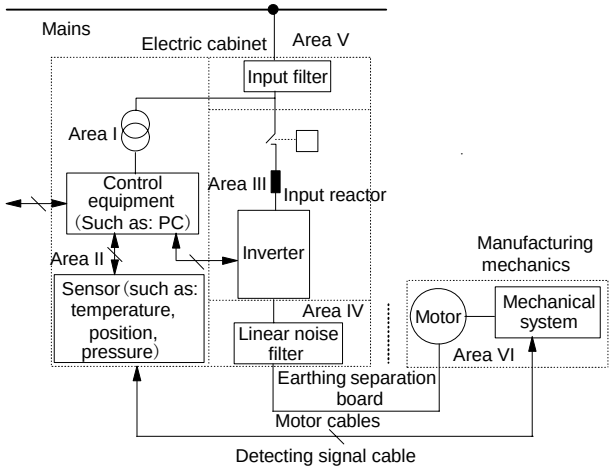


Figure 3-43 Recommendation of Installation space

Attention:

• Area I should be used to install transformers of control power supply, control system and sensor.

• Area II should be used for interfaces of signal and control cables, correct immunity level is required.

• Area III should be used to install noise sources such as input reactor, the drive, brake unit and contactor.

• Area IV should be used to install output noise filter and the wires of filter.

• Area V should be used to install power source and cable connecting parts of RFI filter.

• Area VI should be used to install motor and motor cables.

•Areas should be isolated in space, so that electro-magnetic decoupling effect can be achieved.

• The minimum distance between areas should be 20cm.

•Earthing bars should be used for decoupling among areas, the cables from different area should be placed in different tubes.

• The filter should be installed at the interfaces between different areas if necessary.

• Bus cable(such as RS485) and signal cable must be shielded

Electrical installation of the drive

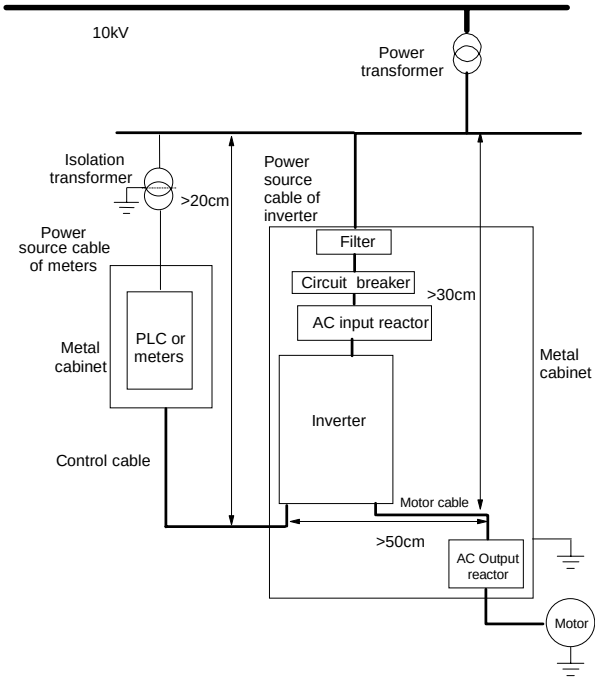


Figure 3-44 Installation of the drive

•Motor cable should be earthed at the drive side, if possible, the motor and drive should be earthed separately;

• Motor cable and control cable should be shielded or armored. The shield must be earthed and avoid entangling at cable end to improve high frequency noise immunity.

• Assure good conductivity among plates, screw and metal case of the drive; use tooth-shape washer and conductive installation plate;

Generally, if there are some sensitive equipment, it is more cost-effective to install the power filter at sensitive equipment side.

3.4.7 Application Of Power Line Filter

Power source filter should be used in the equipment that may generate strong EMI or the equipment that is sensitive to the external EMI. The power source filter should be a two-way low pass filter through which only 50Hz current can flow and high frequency current should be rejected.

Function of power line filter

The power line filter ensures the equipment can satisfy the conducting emission and conducting sensitivity in EMC standard. It can also suppress the radiation of the equipment.

It can prevent the EMI generated by equipment from entering the power cable, and prevent the EMI generated by power cable from entering equipment.

Common mistakes in using power cable filter

1. Too long power cable

The filter inside the cabinet should be located near to the input power source. The length of the power cables should be as short as possible.

2. The input and output cables of the AC supply filter are too close

The distance between input and output cables of the filter should be as far apart as possible, otherwise the high frequency noise may be coupled between the cables and bypass the filter. Thus, the filter will become ineffective.

3. Bad earthing of filter

The filter's enclosure must be earthed properly to the metal case of the drive. In order to be earthed well, make use of a special earthing terminal on the filter's enclosure. If you use one cable to connect the filter to

the case, the earthing is useless for high frequency interference. When the frequency is high, so is the impedance of cable, hence there is little bypass effect.

The filter should be mounted on the enclosure of equipment. Ensure to clear away the insulation paint between the filter case and the enclosure for good earthing contact.

3.4.8 EMI

The drive's operating theory decides that its EMI is unavoidable.

The drive is usually installed in a metal cabinet, the instruments outside the metal cabinet is disturbed by the drive lightly. The cables are the main EMI source, if you connect the cables according to the manual, the EMI can be suppressed effectively.

If you install the drive and other control equipment in one cabinet, the area rule must be observed. Pay attention to the isolation between different area, cable layout and shielding..

Chapter 4 Operation Instructions

4.1 Notice

In the follow-up sections, you may encounter the terms describing the control, running and status of drive many times. Please read this section carefully. It will help you to understand and use the functions to be discussed correctly.

4.1.1 Drive Control Modes

It defines the physical channels by which drive receives operating commands like START, STOP, FWD, REV, JOG and others.

Panel control: The drive is controlled by RUN, STOP and JOG keys on the operation panel;

Terminal control: The drive is controlled by terminals FWD, REV and COM (2-wire mode), or by terminal Xi (3-wire mode);

Host control: The operations such as START and STOP can be controlled by host PC.

The control modes can be selected by parameter F0.03, PANEL/REMOTE key and ENTER/DATA key on the operation panel and multi-function input terminal (No.27, 28 and 29 can be selected by F7.00~F7.07).

Warning:

The user must ensure that the control mode selected is suitable for the application. Wrong selection of control mode may cause damage to equipment or human injury!

4.1.2 Reference Selector

In common operating modes, EV2000 has 6 possible ways to input reference frequency, the reference frequency can be input by:

▲ and ▼ keys on the panel;

Terminals UP/DN;

Serial port;

Analog VCI;

Analog CCI;

Pulse terminal (PULSE)

How to set Frequency

The output frequency is decided after calculating the values from one or more of the above 6 frequency setting methods, which involves the concept of main and auxiliary reference frequency.

Main reference frequency: set by F0.00, multi-speed (MS) or close loop control.

The main reference frequency is decided by the priority of running mode. The priority level is Jog>close loop>PLC>MS (multi-speed)>common running, e.g. if the drive is running in MS mode, the primary reference frequency is MS frequency.

Auxiliary reference frequency: set by F9.01~F9.04.

Preset frequency: the sum of main and auxiliary frequency multiply a factor, which is set in F9.05 and F9.06. Please refer to F9.05, F9.06 and Figure 5-59 in chapter 5.

4.1.3 Operating Status

There are 3 operating status: stopping, motor parameters auto-tuning, and operating.

Stopping status: After the drive is switched on and initialized, if no operating command is accepted or the stopping command is executed, then the drive enters stopping status.

Operating status: The drive enters operating status after it receives the operating command.

Motor parameters auto-tuning status: If there is an operating command after FH.09 is set to 1 or 2, the drive then enters motor parameters auto-tuning status, and then enters stopping status after auto-tuning process is over.

4.1.4 Operating Modes

EV2000 has 5 kinds of operating modes which can be sequenced according to the priority: Jog>Close loop operation>PLC operation>Multi-step speed operation>Simple operation, as shown in Figure 4-1.

Jog:

When the drive is in stopping status, it will operate according to Jog frequency after it receives the Jog operation command(or after the JOG key is pressed). See explanations of F3.13~F3.16 for details.

Close-loop operation:

If the close-loop operating function is enabled(F5.00=1), the drive will select the close-loop operation mode, that is, it will perform PI regulation according to the reference and feedback values (See explanations of Parameter F5). Close-loop operating function can be disabled by a multi-function terminal (No.20 function), and the drive will select an operating mode with a low priority.

PLC operation:

If PLC function is enabled (ones place of F4.00 is set to a non-zero value), the drive will select PLC operating mode and will operate in the pre-defined operating mode (see explanation of parameter F4). The PLC function can be disabled by a multi-function terminal (No. 21 function), and the drive will select an operating mode of lower priority.

Multi-step (MS) speed operation:

Select MS frequency 1~7(F3.23~F3.29,F7.00~F7.07) to start MS speed operation by the ON/OFF combinations of the multi-function terminals (No.1, 2, and 3), if none of the terminals are “OFF”..

Simple operation:

Simple operation is actually the open-loop operation mode.

EV2000 operating status is shown in Figure 4-1:

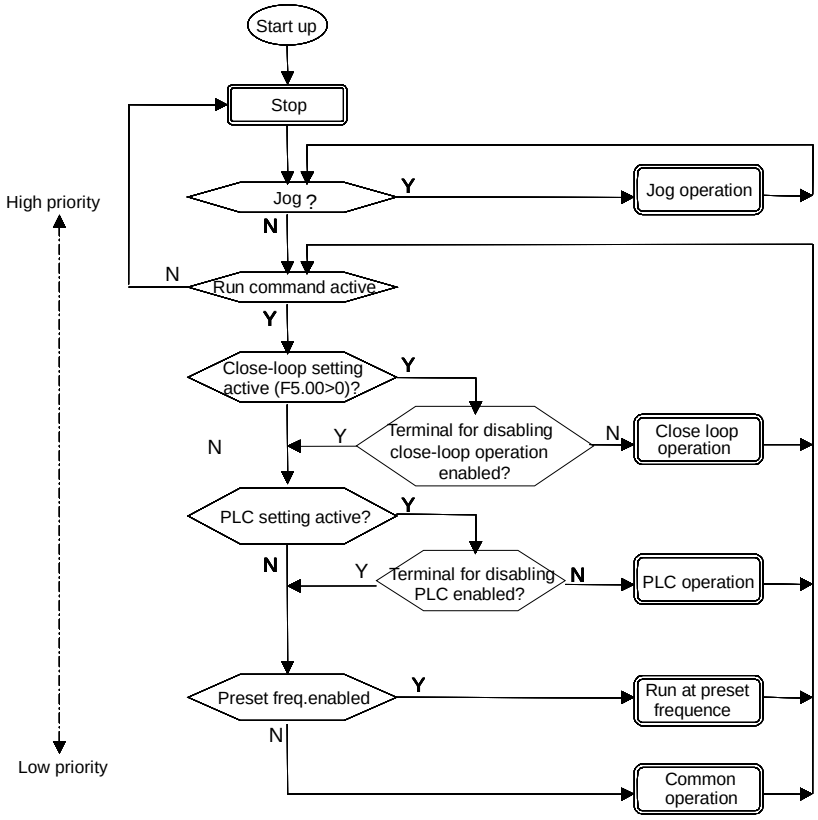


Figure 4-1 Operating status of EV2000

Five operating modes provide 5 basic frequency sources. Except the Jog operating frequency, other 4 kinds of frequency sources can be superposed by the auxiliary frequency to tune the final output frequency. In PLC, MS and common mode, the reference frequency can be used as traverse frequency.

4.2 Operating Instructions

4.2.1 Using Operation Panel

The operation panel is used to setup the drive and display parameters. There are two types of operation panels, one with LED display and the other, LCD display. The LED display is the standard operation panel. The LCD operation panel is an optional accessory. It can display in English and Chinese characters, with description for the displayed data. The outlines, dimensions and operating methods of these two types of operation panels are the same, as shown in Figure4-2.

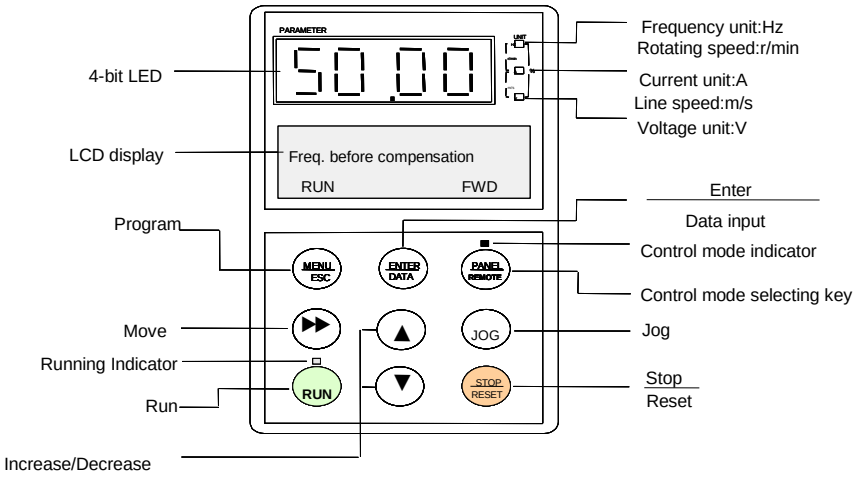


Figure 4-2 Illustration of operation panel

Attention Operation panel of EV2000 is not compatible with the panel of other Emerson variable speed drives.

4.2.2 Keys Function

There are 9 keys on the operation panel of the drive and the functions of each key is shown in Table 4-1.

Table 4-1 Function of operation panel

Key	Name	Function
MENU/ESC	Program/ exit	Enter or exit programming status
ENTER/DATA	Function/ data	Enter lower level menu or confirm data
▲	Increase	Increase data or parameter
▼	Decrease	Decrease data or parameter
▶▶	Shift	In editing status, pressing this key select the Bit to be modified. In other status, this key is used to scroll through the parameters.
PANEL/ REMOTE	Control mode selection	When a control mode is selected, press ENTER/DATA to enter
JOG	Jog key	In panel control mode, press this key to start Jog operation.
RUN	Run key	In panel control mode, press this key to run the drive.
STOP/RESET	Stop/reset	Press this key to stop or reset the drive.

Note

Functions of RUN, JOG, STOP/RESET and PANEL/REMOTE are also limited by F9.07.

4.2.3 Description Of LED & Indicators

The operation panel consists of a 4-digit seven segments display, 3 LED indicators that indicate unit and 2 status indicators as shown in Figure 4-3. The seven segments can display the status parameters, parameters and fault codes of the drive. These 3 unit indicators have 7 different combinations and each combination corresponds to one type of unit. The relationship between the combination of the indicators and the unit is shown in Figure 4-3:

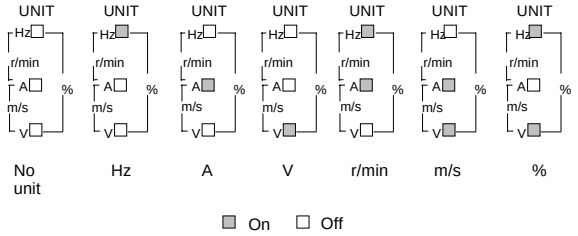


Figure 4-3 Unit represented by combination of the indicators

Two status indicators: Operating status indicator is above the RUN key. The control mode indicator is above the PANEL/REMOTE key, and the functions of these indicators are shown in Table 4-2.

Table 4-2 Functions of status indicators

Indicator	Display status	Current status of the drive
Operating status indicator	Off	Stopping status
	On	Operating status
Control mode indicator	On	Panel control status
	Off	Terminal control status
	Flash	Serial port control status

4.2.4 Drive Display

EV2000 operation panel can display the parameters in stopping, operating, editing and alarming state.

1. Parameters displayed in stopping status

When the drive stops operation, the panel will display the status parameters in stopping status, as shown in Figure 4-4b. The unit indicator on the top right of the panel indicates the unit of the parameter.

Other parameters can be displayed by pressing ▶▶ key (see F8.03).

2. Parameters displayed in operating status

When the drive receives operating command, it starts running and its panel will display the status parameters in operating status, as shown in Figurec of Figure 4-4. The unit indicator at right indicates the unit of the parameter.

Other parameters can be displayed by pressing ▶▶ key (see F8.01 and F8.02).

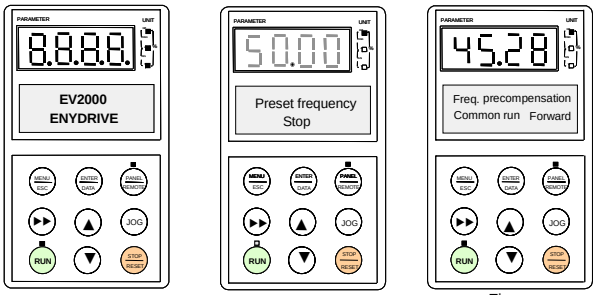


Fig. a
Initialize at power on, all LED turns on

Fig. b
Stopping state, Stopping information is displayed ; RUN indicator turns off

Fig. c
Running state, running information is displayed; RUN indicator turns on

Figure 4-4 Displayed during initialization, STOP, operation

3. Alarm information

When the drive detects a fault signal, the panel will display the fault code. The code will flash to catch your attention as shown in Figure 4-5;

Reference frequency can be viewed by pressing the ▶▶ key in stopping status. Fault information can be queried by pressing MENU/ESC key. The drive can be reset by pressing the STOP/RESET key, or sending the reset commands via the control terminal X2 or serial port. The fault code will not disappear until the fault is cleared.

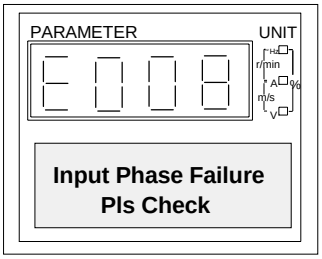


Figure 4-5 Alarm displaying status

4. Parameter configuration

When the drive is in stopping, operating or alarming state, pressing MENU/ESC can enter configuring status,. Configuring status can be displayed in 3-level menu, they are: parameter group→pparameter→parameter value. You can enter the sub-menus by pressing ENTER/DATA. In parameter value menu, press ENTER/DATA to save the settings, and press MENU/ESC to exit the menu.

4.2.5 Panel Operation

1. Viewing Parameters

To view the parameters, press ▶▶ key. The parameters that can be displayed are different depending on the operation state (STOP, operating) and the settings of F8.01~F8.03)

2. Parameter Setup

Let's look at an example of how to set parameters. Suppose you want to change the setting of F3.13 from 5.00Hz to 6.50Hz.

1. Press MENU/ESC key to enter programming state, the LED displays F0.

2. Press ▲ key until "F3" is displayed.

3. Press ENTER/DATA key, you will see F3.00. Press ▲ key until "F3.13" is displayed.

4. Press ENTER/DATA key, you will see "05.00".

5. Press ▶▶key, to move the cursor to the digit "5".

Press ▲ key once, to change it to "6". Press ▶▶key, to move the cursor to the next digit (from left to right) and press ▲ key until the figure "5" appear.

6. Press ENTER/DATA key to save the modification and you will see the next parameter F3.14.

7. Press MENU/ESC key to exit the programming state.

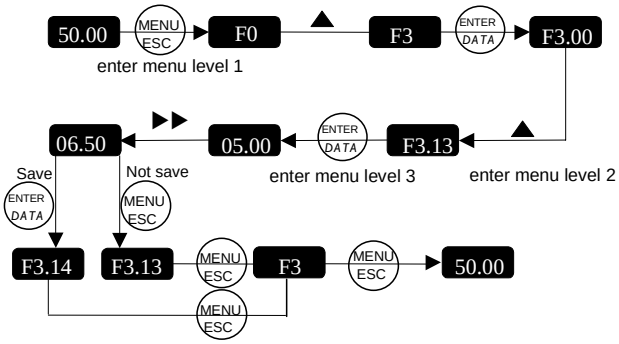


Figure 4-7 Setting the parameters

In menu level 3, the settings of the parameter cannot be changed if none digit of the parameter is flashing. The possible reasons are:

1) The settings of this parameter cannot be changed, such as the actual detected parameters or recorded parameters;

2) The settings of this parameter cannot be changed when the drive is operating, and can only be changed when the drive stops;

3) The parameters are protected, that is, if FP.01 is set to 1 or 2, the settings of all the parameters cannot be changed to avoid wrong operation. If you really want to change the settings, first set FP.01 to 0.

3. Fine Tuning reference frequency

Example: changing the reference frequency from 50.00Hz to 48.00Hz.

Just press ▼ key directly regardless of the current display, the present frequency setting will appear and decrease 0.01Hz. Holding the key will speed up the decrease. Press ▲ key to increase the frequency by 0.01Hz.

4. Changing the control mode:

Set F9.07 to "x1x" or "x2x", and control mode is allowed changing. If F9.07 is set to "x1x", the control mode can be changed at STOP state; if set at "x2x", the control modes can be changed in both operation and STOP state.

PANEL/REMOTE key can be used to select the control mode both in operating status and stopping status.

Press this key and you can switch among panel control mode, terminal control mode and serial port mode. When panel control mode is selected, the LED beside the PANEL/REMOTE will turn on; when terminal control mode is selected, the LED will turn off; when serial port control mode is selected, the LED will blink.

5. Starting and Stopping the drive

Under panel control mode, press RUN key to start the drive and press STOP/RESET key to stop it. To switch the control mode, please refer to the above paragraph.

6. Jog

When the drive is in STOP state, press JOG key and hold it, the panel will display start frequency and then the frequency will ramp to 5Hz. Keep pressing the key, the drive will jog at 5Hz.

7. Setting user's password

Enter menu level 3 and set FP.00 at a 4-digit figure as your password. See the panel operation in Figure 4-7.

8. How to lock the panel:

First set the hundred's place of F9.07 at a non-zero figure, and then press MENU/ESC and ENTER/DATA at the same time.

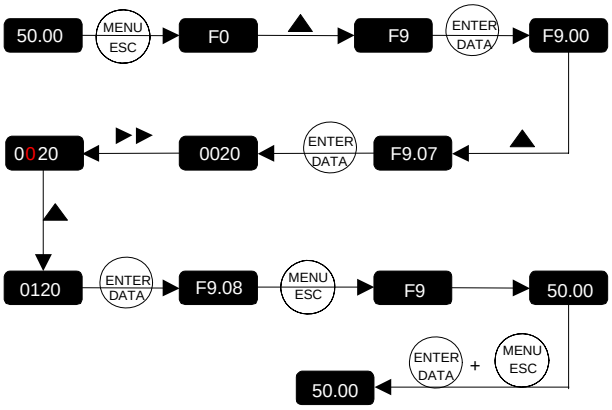


Figure 4-8 Locking panel

9. How to unlock the panel

At stopping or operating state, press ENTER/DATA key, and then press ▼ three times. Note that the operation will not change the value of F9.07.

Note:

Even if the hundred's place of F9.07 is not set to zero (panel locking function is enabled), the panel is in unlocking status every time the drive is powered on.

4.3 Start-up

4.3.1 Pre-startup Check

Please wire the drive according to Section 3.3, and refer to Figure 3-7.

4.3.2 First Poweron

After checking the wiring and AC supply, switch on the circuit breaker of the drive to supply AC power to it. The drive's panel will display "8.8.8.8." at first, and then the contactor closes. If the LED displays the frequency settings, the initialization of the drive is completed.

If the LED on the PANEL/REMOTE is on, the drive is in panel control mode.

Procedures of first-time start-up:

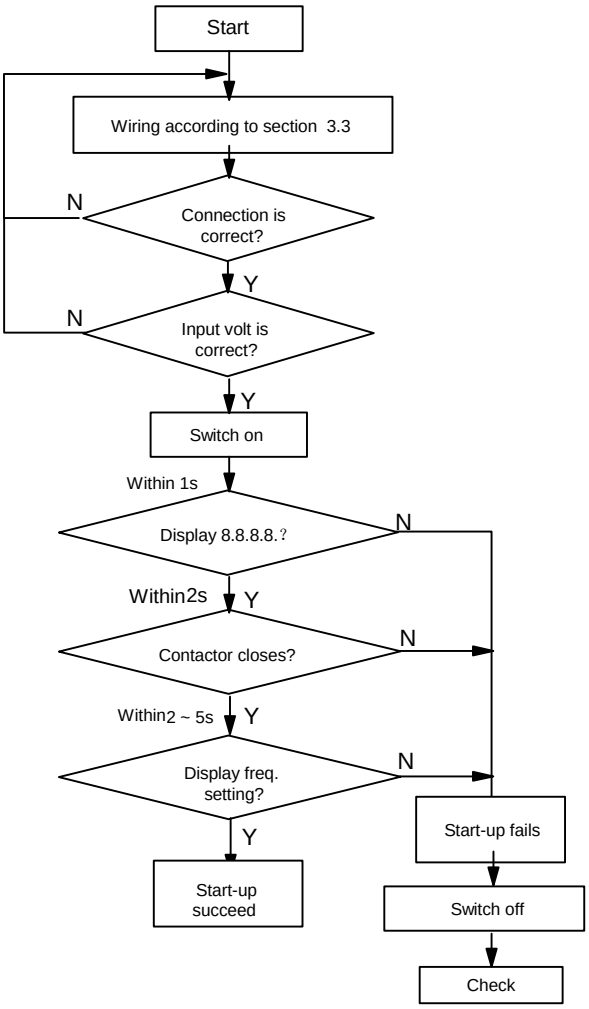


Figure 4-8 Procedures of starting the drive for the first-time

Chapter 5 Parameter Introductions

Note

The values in "【】" are the factory settings.

5.1 Basic Parameters (Group F0)

F0.00 Reference frequency selector	Range:0~5 【0】

0:digital setting 1

To set the reference frequency via ▲ and ▼ keys on the panel.

Initial frequency is the value of F0.02 and it can be adjusted via ▲ and ▼ keys on the panel.

1: digital setting 2

To set the reference frequency via terminal UP/DN

Initial frequency is the value of F0.02 and it can be adjusted via terminal UP/DN.

2: digital setting 3

To set the reference frequency via serial port

Initial frequency is the value of F0.02 and it can be adjusted via serial port.

3:VCI analog input (VCI-GND)

The reference frequency is set by analog voltage input via terminal VCI and the input voltage range is DC 0~10V.

4:CCI analog input(CCI-GND)

The reference frequency is set by analog voltage or current input via terminal CCI and the input range is DC 0~10V(if jumper CN10 is placed at "V" side) or DC0~20mA(if jumper CN10 is placed at "I" side).

5: Pulse input (PULSE)

Set the reference frequency by pulse input via pulse terminal (can only be input via terminal X7 or X8, see the definitions of F7.06~F7.07). Input pulse signal: voltage range: 15~30V; frequency range:0~50.0kHz.

Note

Frequency calculating methods of Modes 3, 4 and 5 are decided by F1.00~F1.11, please refer to section 5.2.

F0.01 Digital frequency control	Range: 00~11 【00】

Only valid when F0.00=0, 1 or 2.

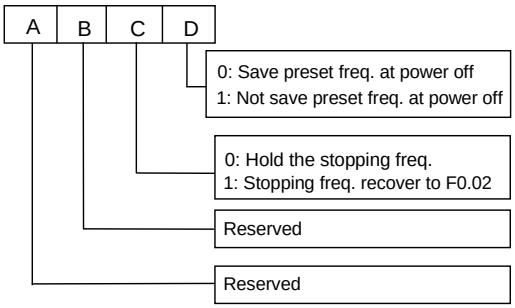


Figure 5-1 LED setting

Where,

A: thousand's place B: Hundred's place

C: Ten's place D: Unit's place

Unit's place of LED:

0 (frequency setting can be saved at power off): When the drive is switched off or under voltage fault occurs, the setting of F0.02 will be refreshed to the present frequency value.

1 (frequency setting can not be saved at power off): When the drive is switched off or under voltage fault occurs, the setting of F0.02 will not be changed.

Ten's place of LED:

0 (Maintaining the frequency setting in stopping process): When the drive is stopping, the frequency setting is the final frequency value.

1 (frequency setting is refreshed to the setting of F0.02): When the drive is stopping, the frequency setting will be refreshed to the setting of F0.02 automatically.

F0.02 Set the operating frequency in digital mode	Range: Lower limit of frequency ~upper limit of frequency【50.00Hz】

When the reference frequency is set in digital mode(F0.00＝0, 1, 2), this setting of F0.02 is the drive's initial frequency value.

F0.03 Methods of inputting operating commands	Range: 0. 1. 2 【0】

EV2000 has 3 control modes (Methods of inputting operating commands)

0: Panel control: Input operating commands via panel

Start and stop the drive by pressing RUN, STOP and JOG on the panel.

1: Terminal control: Input operating commands via terminals

Use terminals FWD, REV, JOGF and JOGR to start and stop the drive.

2: Serial port control: Input commands via serial port

Use serial port to start and stop the drive.

Note

Please be careful that during operating, the control modes can be changed through F0.03 or external terminals or PANEL/REMOTE key.

F0.04 Set running direction	Range: 0, 1 【0】

This function is active in keypad control mode only, but inactive in serial port control mode nor terminal control mode.

0: Forward

1: Reverse

F0.05 Max output frequency	Range: Max{50.00,F0.12 upper limit of frequency}~650.00Hz【50.00Hz】
F0.06 Basic operating frequency	Range:1.00~650.00Hz 【50.00Hz】
F0.07 Max output voltage	Range:1~480V 【drive's rating values】

Max output frequency is the highest permissible output frequency of the drive, as shown in Figure 5-2 as f_{max};

Basic operating frequency is the Min frequency when the drive outputs the max voltage, as shown in Figure 5-2 as f_b

Max output voltage is the drive's output voltage when the drive outputs basic operating frequency, as shown in Figure 5-2 as V_{max}

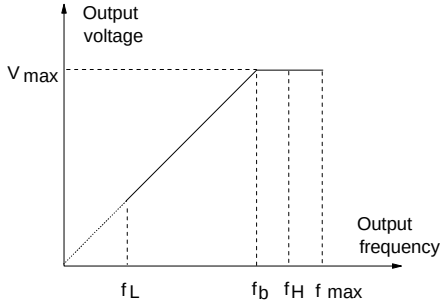


Figure 5-2 Characteristic parameters

The f_H and f_L are defined by F0.12 and F0.13 as upper limit of frequency and lower limit of frequency respectively.

Note:

Please set fmax, fb and Vmax according to motor parameters, otherwise the equipment may be damaged.

F0.08 Drive type selection	Range:0. 1【0】

0: Type G (load with constant torque)

1: Type P (fan & pump load)

EV2000 series drive of 45kW or below uses the type G and type P integrated mode. The power of motor matched with the drive type G is lower than that of type P. Please refer to Table 2-2 for details.

The factory setting of the drive is set to type G.

For example: EV2000-4T0055G/0075P drive's factory setting is 5.5kW type G drive. If the drive needs to be changed to 7.5kW type P drive, then:

①set this parameter to 1

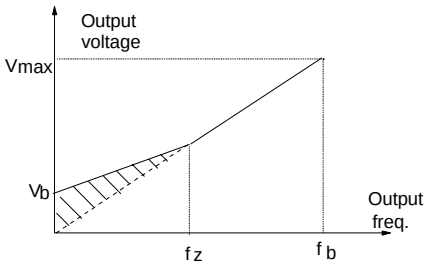
②set group FH parameters again

Note

Follow the same procedures if the drive needs to be changed from type P to type G.

F0.09 Torque boost	Range:0~30.0%【0. 0%】

In order to compensate the torque drop at low frequency, the drive can boost the voltage so as to boost the torque. If F0.09 is set to 0, auto torque boost is enabled and if F0.09 is set non-zero, manual torque boost is enabled, as shown in Figure 5-3.



V_b : Manual torque boost Vmax: Max output voltage
f_z : Cut-off freq. for torque boost
f_b : Basic operating freq.

Figure 5-3 Torque boost(shadow area is the boosted value)

Note

1. Wrong parameter setting can cause overheat or over-current protection of the motor.

2. Refer to F0.21 for definition of fz.

3. When the drive drives a synchronous motor，torque boost function is recommended to be used and V/F curve should be adjusted according to the motor parameters.

F0.10 Acc time 1	Range:0.1~3600s(min)【6.0s/20.0s】
F0.11 Dec time 1	Range:0.1~3600s(min)【6.0s/20.0s】

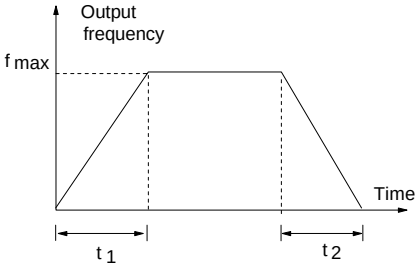


Figure 5-4 Acc/Dec time definition

Acc time is the time taken for the motor to accelerate from 0Hz to the maximum frequency (as set in F0.04), see t_1 in Figure 5-4.

Dec time is the time taken for the motor to decelerate from maximum frequency (F0.05) to 0Hz, see t_2 in Figure 5-4.

EV2000 series drive has defined 4 kinds of Acc/Dec time. Here only Acc/Dec time 1 is defined, and Acc/Dec time 2~4 will be defined in F3.17~F3.22, please refer to section 5.4.

Note

1. Unit(second/minute) of Acc/Dec time 1~4 is dependent on the setting of F9.09, and the default unit is second.

2. For the drive of 30kW or above, the factory setting of Acc/Dec time is 20.0s.

F0.12 upper limit of frequency	Range: Lower limit of frequency ~Max output frequency【50.00Hz】
F0.13 lower limit of frequency	Range:0~upper limit of frequency 【0.00Hz】

F0.12 and F0.13 define the upper and lower limit of frequencies respectively, as shown in Figure 5-2 as f_H and f_L.

Note

Actual output frequency is possible to exceed ± 2.5Hz in the bus-voltage control process.

F0.14 V/F curve setting	Range: 0~3【0】
F0.15 V/F frequency value F3	Range: F0.17~F0.06【0.00Hz】
F0.16 V/F voltage value V3	Range: F0.18~100.0%【0.0%】
F0.17 V/F frequency value F2	Range: F0.19~F0.15【0.00Hz】
F0.18 V/F voltage value V2	Range: F0.20~F0.16【0.0%】
F0.19 V/F frequency value F1	Range: 0~F0.17【0.00Hz】
F0.20 V/F voltage value V1	Range:0~F0.18【0.0%】

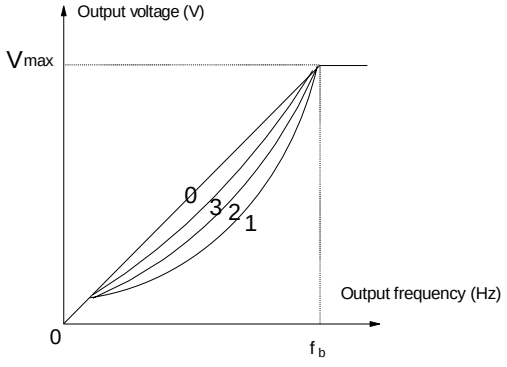
This group of parameters define the V/F setting modes of EV2000 so as to satisfy the requirements of different loads. 3 preset curves and one user-defined curve can be selected according to the setting of F0.14.

If F0.14 is set to 1, a 2-order curve is selected, as shown in Figure 5-5 as curve 1;

If F0.14 is set to 2, a 1.7-order curve is selected, as shown in Figure 5-5 as curve 2;

If F0.14 is set to 3, a 1.2-order curve is selected, as shown in Figure 5-5 as curve 3;

The above curves are suitable for the variable-torque loads such as fan & pumps. You can select the curves according to the actual load so as to achieve best energy-saving effects.



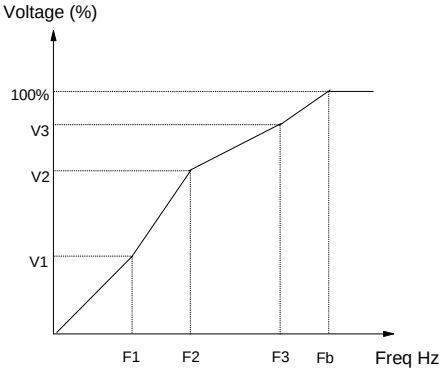
V_{max} : Max output voltage(F0.07)

f_b : Basic operating frequency(F0.06)

Figure 5-5 Torque-reducing curve

If F0.14 is set to 0, you can define V/F curve via F0.15~F0.20, as shown in Figure 5-6. The V/F curve can be defined by connecting 3 points of (V1,F1), (V2,F2) and (V3, F3), to adapt to special load characteristics.

Default V/F curve set by factory is a direct line as show in Figure 5-5 as curve 0.



V1~V3: Voltage of sections 1~3
F1~F3: Freq of sections 1~3
Fb: Basic operating freq. of F0.06

Figure 5-6 V/F curve defined by user

F0.21 Cut-off point used for manual torque boost	Range:0~50%【10.0%】

F0.21 defines the ratio of the cut-off frequency used for manual torque boost to the basic operating frequency(defined by F0.06), as shown in Figure 5-3 as fz. This cut-off frequency adapts to any V/F curve defined by F0.14.

5.2 Reference Frequency Parameters (Group F1)

F1.00 Reference frequency curve selection	Range:000~111【000】
F1.01 Gain of reference frequency selector	Range:0.00~9.99【1.00】
F1.02 Reference constant of filter	Range:0.01~50.00s【0.50s】
F1.03 Max input pulse frequency	Range:0.1~50.0kHz【10.0kHz】
F1.04 Min reference of curve 1	Range:0.0%~100.0%【0.0%】
F1.05 Frequency corresponding to the Min reference of curve 1	Range:0.0~650.0Hz【0.00Hz】
F1.06 Max reference of curve 1	Range:0.0%~100.0%【100.0%】
F1.07 Frequency corresponding to the Max reference of curve 1	Range:0.0~650.0Hz【50.00Hz】
F1.08 Min reference of curve 2	Range:0.0%~100.0%【0.0%】
F1.09 Frequency corresponding to the Min reference of curve 2	Range:0.0~650.0Hz【0.00Hz】
F1.10 Max reference of curve 2	Range:0.0%~100.0%【100.0%】
F1.11 Frequency corresponding to the Max reference of curve 2	Range:0.0~650.0Hz【50.00Hz】

When VCI or CCI or pulse input(PULSE) is selected, the relationship between reference and the preset frequency is given below:

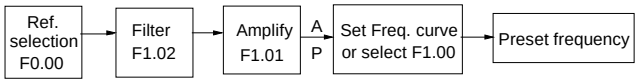


Figure 5-7 Reference vs. preset frequency

Reference frequency signal is filtered and amplified, and then its relationship with the preset frequency is determined by Curve 1 or 2. Curve 1 is defined by F1.04~F1.07, and curve 2 is defined by F1.08~F1.11. Positive and negative characteristics are shown in Figure 5-8.

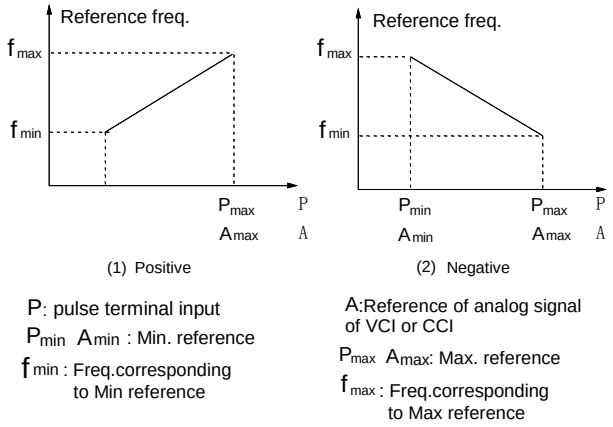


Figure 5-8 Output frequency curve

Analog input value(A) is a percentage without unit, and 100% corresponds to 10V or 20mA. Pulse frequency(P) is also a percentage without unit, and 100% corresponds to the Max pulse frequency defined by F1.03.

F1.02 defines the time constant of the filter used by the reference selector. The input signal is filtered and the bigger the time constant, the higher the immunity level, but the response time is prolonged with the increase of the time constant. That is, the smaller the time constant, the shorter the response time, but the lower the immunity level.

F1.00 is used to select the output frequency curve when VCI, CCI or PULSE input is selected, as shown in Figure5-9.

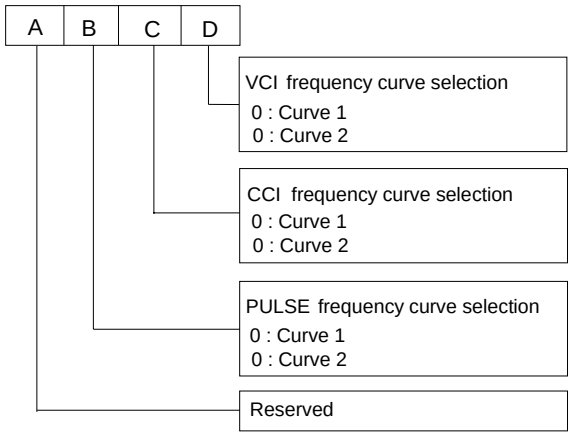


Figure 5-9 Frequency curve selection

Where,

A: thousand's place B: Hundred's place

C: Ten's place D: Unit's place

For example, the requirements are:

①Use the pulse signal input via terminal to set the reference frequency;

②Range of input signal frequency:1kHz~20kHz;

③1kHz input signal corresponds to 50Hz reference frequency, and 20kHz input signal corresponds to 5Hz reference frequency;

According to the above requirements, the parameter settings are:

①F0.00=5, select pulse input to set the reference frequency;

②F7.06=45, input pulse signal via terminal X7;

③F1.00=100, select curve 2;

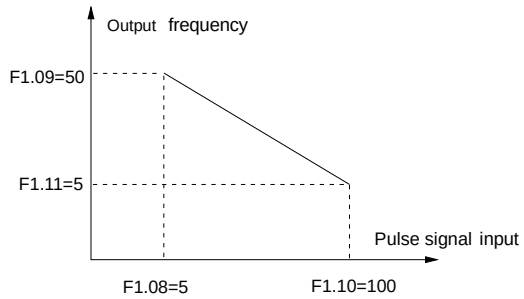
④F1.03=20.0kHz, set the Max input pulse frequency to 20kHz;

⑤F1.08=1÷20×100%=5.0%, the minimum reference of curve 1 is actually the percentage of 1kHz to 20kHz(F1.03);

⑥F1.09=50.00Hz, set the frequency that corresponds to the Min reference (1kHz pulse signal);

⑦F1.10=20÷20×100%=100.0%, the Max reference of curve 2 is actually the percentage of 20kHz to 20kHz(F1.03);

⑧F1.11=5.00Hz, set the frequency that corresponds to the Max reference (20kHz pulse signal);



F0.00=5, F1.00=100, F1.03=20, F7.06=45

Figure 5-10 Pulse signal input

5.3 Starting & Braking Parameters (Group F2)

F2.00 Starting mode	Range:0. 1. 2【0】

0: Start from the starting frequency

Start at the preset starting frequency (F2.01) within the holding time of starting frequency (F2.02).

1:Brake first and then start

Brake first(refer to F2.03 and F2.04), and then start in mode 0.

2. Start on the fly

Search and catch the motor's running direction and speed, start the rotating motor smoothly without impact, as shown in Figure 5-11.

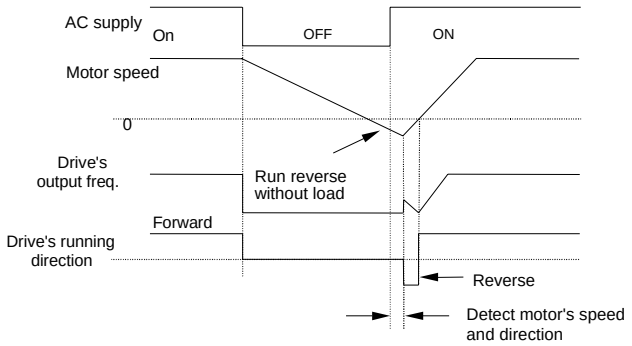


Figure 5-11 Start on the fly

Note

1. Starting mode 1 is suitable for starting the motor that is running forward or reverse with small inertia load when the drive stops. For the motor with big inertial load, it is recommended to use starting mode 2;

2. The starting performance of starting mode 2 is dependent on the motor's parameters. Please set the parameter group FH correctly.

3. Starting mode 0 is recommended when the drive drives a synchronous motor.

F2.01 Starting frequency	Range:0.20~60.00Hz【0.50Hz】
F2.02 Holding time of starting frequency	Range:0.0~10.0s【0.0s】

Starting frequency is the initial frequency when the drive starts, as shown in Figure 5-12 as f_S; Holding time of starting frequency is the time during which the drive operates at the starting frequency, as shown in Figure 5-12 as t_1

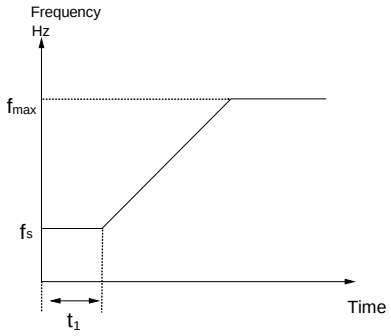


Figure 5-12 Starting frequency and starting time

Note

Starting frequency is not restricted by the lower limit of frequency.

F2.03 DC injection braking current at start	Range: dependent on drive's model【0.0%】
F2.04 DC injection braking time at start	Range: dependent on drive's model【0.0s】

F2.03 and F2.04 are only active when F2.00 is set to 1 (starting mode 1 is selected), as shown in Figure 5-13.

The range of DC injection braking current and time are dependent on the drive's model, see Table 5-1.

DC injection braking current at start is a percentage value of drive's rated current. There is no DC injection braking when the braking time is 0.0s.

Table 5-1 DC injection braking function

Model	The range of current	The range of time
G 型	0~100.0%	0.0~30.0s
P 型	0~80.0%	0.0~30.0s

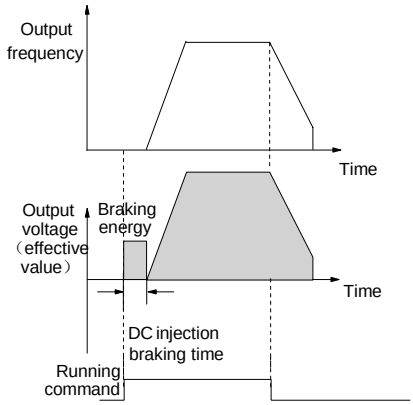


Figure 5-13 Starting mode 1

F2.05 Acc/Dec mode	Range:0. 1. 2【0】

0: Linear Acc/Dec mode

Output frequency increases or decreases according to a constant rate, as shown in Figure 5-14.

1: S ramp Acc/Dec

Output frequency increases or decreases according to a S-shape curve, as shown in Figure 5-15.

2: Acc/Dec mode with current limiting function

The drive can maintain its output current below the current limiting threshold (see FL.07) automatically and complete the Acc or Dec process according to the load condition.

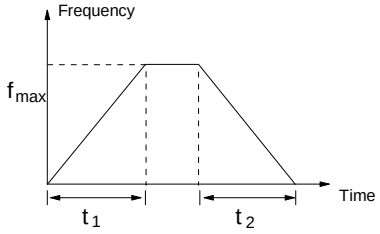


Figure 5-14 Linear Acc/Dec

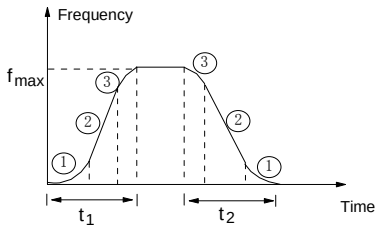


Figure 5-15 S-ramp Acc/Dec

Note:

In auto Acc/Dec mode, settings of F0.10, F0.11 and F3.17~F3.22 are invalid.

F2.06 Starting time of S ramp	Range:10~50%【20.0%】
F2.07 Rising time of S ramp	Range:10~80%【60.0%】

F2.06 and F2.07 are only active when the Acc/Dec mode is S-ramp Acc/Dec mode(F2.05=1), and F2.06+F2.07≤ 90%.

Starting process of S-shape curve is shown in Figure 5-15 as "①" , where the change rate of output frequency increases from 0;

Rising process of S-shape curve is shown in Figure 5-15 as "②", where the output frequency's changing rate is constant;

Ending process of S-shape curve is shown in Figure 5-15 as "③", where the changing rate of output frequency decreases to 0;

S-ramp Acc/Dec mode is suitable for the conveying load such as elevator and conveying belt.

F2.08 Stopping mode	Range:0. 1. 2【0】

0: Dec-to-stop

After receiving the stopping command, the drive reduces its output frequency according to the Dec time, and stops when the frequency decreases to 0.

1: Coast-to-stop

After receiving the stopping command, the drive stops outputting power immediately and the motor stops under the effects of mechanical inertia.

2: Dec-to-stop+DC injection braking

After receiving the STOP command, the drive reduces its output frequency according to the Dec time and starts DC injection braking when its output frequency reaches the initial frequency of braking process.

Refer to the introductions of F2.09~F2.12 for the functions of DC injection braking.

F2.09 DC injection braking initial frequency at stop	Range:0.00~60.00Hz【0.00Hz】
F2.10 DC injection braking waiting time at stop	Range:0.00~10.00s【0.00s】
F2.11 DC injection braking current at stop	Range: dependent on drive's model【0.0%】
F2.12 DC injection braking time at stop	Range: dependent on drive's model【0.0s】

DC injection braking waiting time at stop: The duration from the time when operating frequency reaches the DC injection braking initial frequency (F2.09) to the time when the DC injection braking is applied.

The drive has no output during the waiting time. By setting waiting time, the current overshoot in the initial stage of braking can be reduced when the drive drives a high power motor.

The range of DC injection braking current and time are dependent on drive's model, see Table 5-2.

DC injection braking current at stop is a percentage of drive's rated current. There is no DC injection braking when the braking time is 0.0s.

Table 5-2 DC injection braking function

Model	Braking current at stop	Braking time at stop
G 型	0~100.0%	0.0~30.0s
P 型	0~80.0%	0.0~30.0s

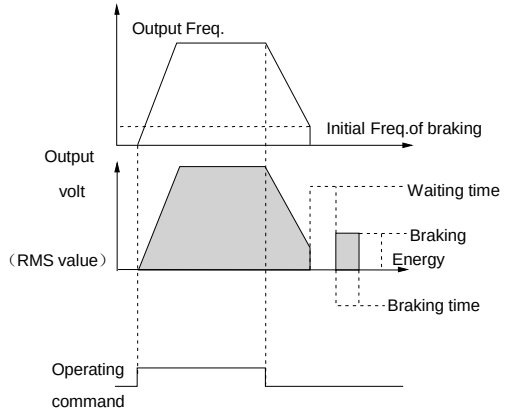


Figure 5-16 Dec-to-stop + DC injection braking

Note

DC injection braking current at stop(F2.11) is a percentage value of drive's rated current.

F2.13 Dynamic braking	Range:0,1【0】

0: Dynamic braking is disabled

1: Dynamic braking is enabled

Note

This parameter must be set correctly according to the actual conditions, otherwise the control performance may be affected.

F2.14 Ratio of working time of braking kit to drive's total working time	Range:0.0~ 100.0%【2.0%】

This function is effective for the drive with built-in braking resistor.

Note:

Resistance and power of the braking resistor must be taken into consideration when setting this parameters.

5.4 Auxiliary Operating Parameters (Group F3)

F3.00 Anti-reverse running function	Range:0. 1【0】

0: disabled

1: enabled

Note:

This function is effective in all control modes.

F3.01 Delay time of run reverse/forward	Range:0~3600s【0.0s】

The delay time is the transition time at zero frequency when the drive switching its running direction as shown in Figure 5-17 as t_1.

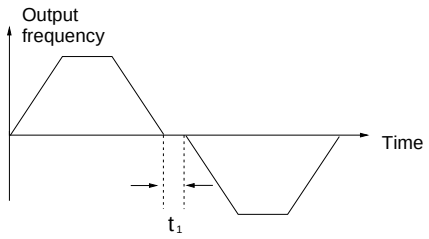


Figure 5-17 Delay time from reverse running to forward running or from forward running to reverse running

F3.02~F3.04	Reserved

Reserved.

F3.05 auto energy-saving function	Range:0. 1【0】

0:disabled

1: enabled

When the motor operates without load or with light load, the drive can adjust its output voltage by detecting the load current to achieve the energy-saving effects.

Note

This function is especially useful for the fan & pump loads.

F3.06 AVR function	Range:0. 1. 2【2】

0:disabled

1: enabled all the time

2: disabled in Dec process

AVR means automatic voltage regulation.

The function can regulate the output voltage and make it constant. Therefore, generally AVR function should be enabled, especially when the input voltage is higher than the rated voltage.

In Dec-to-stop process, if AVR function is disabled, the Dec time is short but the operating current is big. If AVR function is enabled all the time, the motor decelerates steadily, the operating current is small but the Dec time is prolonged.

F3.07 Gain of slip compensation	Range:0.0~300.0%【100.0%】
F3.08 Limit of slip compensation	Range:0.0~250.0%【200.0%】
F3.09 Compensation time constant	Range:0.1~25.0s【2.0s】

The motor's slip changes with the load torque, which results in the variance of motor speed. The drive's output frequency can be adjusted automatically through slip compensation according to the load torque. Therefore the change of speed due to the load change is reduced as shown in Figure 5-18.

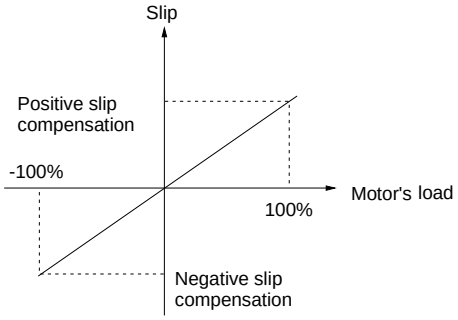


Figure 5-18 Auto slip compensation

Motoring status: Increase the gain of slip compensation gradually when the actual speed is lower than the reference speed (F3.07).

Regenerating status: Increase the gain of slip compensation gradually when the actual speed is higher than the reference speed (F3.07).

Range of slip compensation: limit of slip compensation(F3.08) × rated slip(FH.08)

Note

The value of automatically compensated slip is dependent on the motor's rated slip, therefore the motor's rated slip must be set correctly (FH.08).

F3.10 Carrier wave frequency	Range:0.7~15.0kHz【depend on drive model】

Table 5-3 Drive's type and carrier wave frequency (CWF)

CWF / Type	Highest (kHz)	Lowest (kHz)	Factory setting (kHz)
Type G:5.5kW~45kW Type P:7.5kW~55kW	15	3	8
Type G:55kW~90kW Type P:75kW~110kW	10	1	3
Type G:110kW~220kW Type P:132kW~280kW	6	0.7	2

Table 5-4 CWF characteristics

CWF	Decrease	Increase
Motor's noise	↑	↓
Leakage current	↓	↑
Disturbance	↓	↑

Notes

In order to achieve better control performances, the ratio of carrier frequency to the maximum operating frequency of the drive should not be less than 36.

F3.11 Auto adjusting of CWF	Range:0. 1【1】

0: disabled

1: enabled

When this function is enabled, the drive can adjust the CWF automatically according to the internal temperature of the drive. At this time, the drive's actual Max CWF is restricted by F3.10.

F3.12 Motor tone adjustment	Range:0~10【0】

F3.12 can be used to adjust the motor's tone, and is only effective for the CWF below 6kHz.

If this parameter is set to 0, the function is disabled.

F3.13 Jog operating frequency	Range:0.10~50.00Hz 【5.00Hz】
F3.14 Interval of Jog operation	Range:0.0~100.0s【0.0s】
F3.15 Acc time of Jog operation	Range:0.1~60.0s【6.0s/20.0s】
F3.16 Dec time of Jog operation	Range:0.1~60.0s【6.0s/20.0s】

F3.13~F3.16 define the relevant parameters of Jog operation.

As shown in Figure 5-19, t_1 and t_3 are the actual Acc time and Dec time respectively. t_2 is the Jog operating time; t_4 is the interval of Jog operation(F3.14); f_1 is the Jog operating frequency(F3.13).

Actual Acc time t_1 can be determined by the following formula, so does the actual Dec time t_3 of jog operation.

$$t_1 = \frac{F3.13 \times F3.15}{F0.05}$$

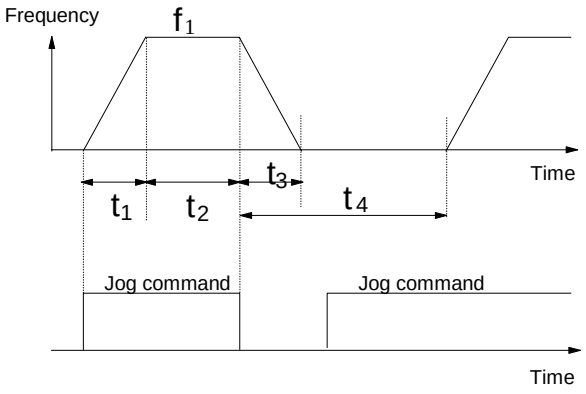


Figure 5-19 Jog operating parameters

Interval of Jog operation (F3.14) is the interval from the time when the last Jog operation command is ended to the time when the next Jog operation command is executed.

The jog command sent during the interval will not be executed. If this command exists until the end of the interval, it will be executed.

Note

1. In Jog operation process, the drive starts according to starting mode 0 and stops according to stopping mode 0. The unit of Acc/Dec time is second.

2. Jog operation can be controlled by panel, terminals and serial port.

F3.17 Acc time 2	Range: 0.1~3600s(min) 【6.0s/20.0s】
F3.18 Dec time 2	Range: 0.1~3600s(min) 【6.0s/20.0s】
F3.19 Acc time 3	Range: 0.1~3600s(min) 【6.0s/20.0s】
F3.20 Dec time 3	Range: 0.1~3600s(min) 【6.0s/20.0s】
F3.21 Acc time 4	Range: 0.1~3600s(min) 【6.0s/20.0s】
F3.22 Dec time 4	Range: 0.1~3600s(min) 【6.0s/20.0s】

Three kinds of Acc/Dec time can be defined, and the drive's Acc/Dec time 1~4 can be selected by different combinations of control terminals, refer to the introductions of F7.00~F7.07 for the definitions of terminals used to select Acc/Dec time.

Note

1. Acc/Dec time 1 is defined in F0.10 and F0.11.

2. For the drive of 30kW or above, its factory setting of Acc/Dec time is 20.0s.

F3.23 Preset frequency 1	Range: Lower limit of frequency ~upper limit of frequency【 5.00Hz】
F3.24 Preset frequency 2	Range: Lower limit of frequency ~upper limit of frequency【10.00Hz】
F3.25 Preset frequency 3	Range: Lower limit of frequency ~upper limit of frequency【20.00Hz】
F3.26 Preset frequency 4	Range: Lower limit of frequency ~upper limit of frequency【30.00Hz】
F3.27 Preset frequency 5	Range: Lower limit of frequency ~upper limit of frequency【40.00Hz】
F3.28 Preset frequency 6	Range: Lower limit of frequency ~upper limit of frequency【45.00Hz】
F3.29 Preset frequency 7	Range: Lower limit of frequency ~upper limit of frequency【50.00Hz】

These frequencies will be used in simple PLC operation and multi-step speed operation, refer to the introductions of F7.00~F7.07 and group F4 parameters.

F3.30 Skip frequency 1	Range:0.00~650.00Hz【0.00Hz】
F3.31 Range of skip frequency 1	Range:0.00~30.00Hz【0.00Hz】
F3.32 Skip frequency 2	Range:0.00~650.00Hz【0.00Hz】
F3.33 Range of skip frequency 2	Range:0.00~30.00Hz【0.00Hz】
F3.34 Skip frequency 3	Range:0.00~650.00Hz【0.00Hz】
F3.35 Range of skip frequency 3	Range:0.00~30.00Hz【0.00Hz】

F3.30~F3.35 define the output frequency that will cause resonant with the load, which should be avoided. Therefore, the drive will skip the above frequency as shown in Figure 5-2020. Up to 3 skip frequencies can be set.

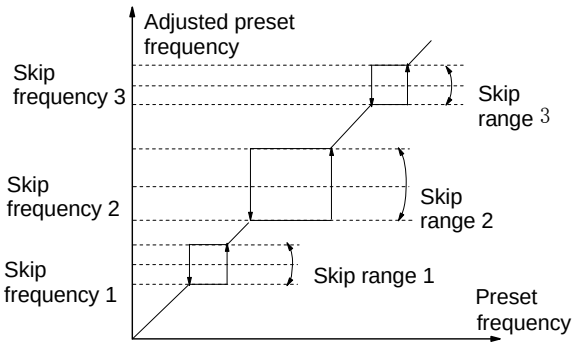


Figure 5-20 Skip frequency and skip range

5.5 PLC Operating Parameters (Group F4)

Simple PLC function can enable the drive change its operating frequency and directions automatically according to the operating time to satisfy the manufacturing requirements. Before, this function is realized by PLC, now the drive itself can realize such function, as shown in Figure 5-21.

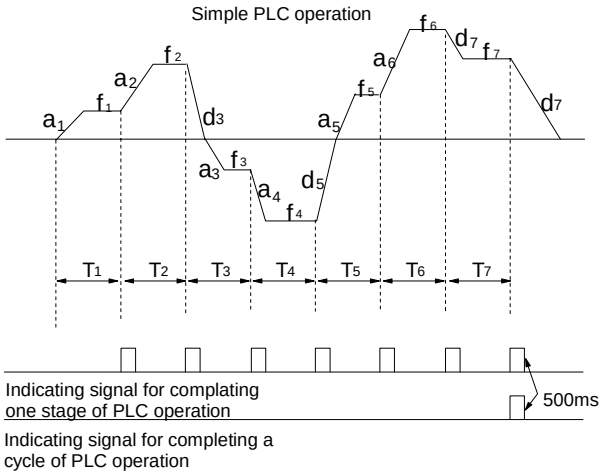

Simple PLC operation
Indicating signal for complating one stage of PLC operation
500ms
Indicating signal for completing a cycle of PLC operation

Figure 5-21 Simple PLC operation

In Figure 5-21, a_1~a_7 and d_1~d_7 are the Acc time and Dec time in different stages. f_1~f_7 and T_1~T_7 will be defined in the following parameters.

Bi-direction open-collector output terminals Y1 and Y2 or the relay that output the 500ms pulse can indicate the completion of PLC operation, refer to the introductions of F7.10~F7.12.

F4.00 Simple PLC operation mode	Range: 0000~1123【0000】

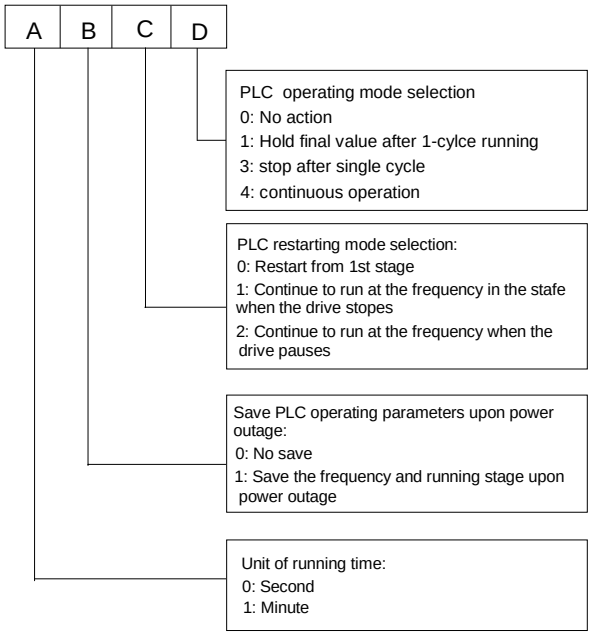

A
B
C
D
PLC operating mode selection
0: No action
1: Hold final value after 1-cylce running
3: stop after single cycle
4: continuous operation
PLC restarting mode selection:
0: Restart from 1st stage
1: Continue to run at the frequency in the stafe when the drive stopes
2: Continue to run at the frequency when the drive pauses
Save PLC operating parameters upon power outage:
0: No save
1: Save the frequency and running stage upon power outage
Unit of running time:
0: Second
1: Minute

Figure 5-22 Simple PLC operation mode

Where,

A: thousand's place B: Hundred's place

C: Ten's place D: Unit's place

Unit's place: PLC operation mode

0:disabled

PLC operation mode is disabled.

1: Stop after single cycle

As shown in Figure 5-23, the drive stops automatically after one cycle of operation and will start when receiving RUN command again.

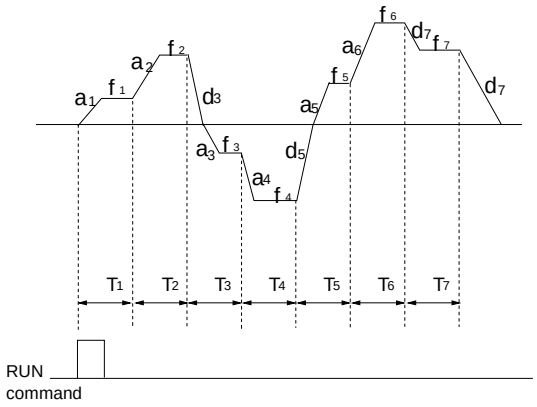


Figure 5-23 Stopping mode after single cycle of PLC

2: Maintain the final value after single cycle of operation

As shown in Figure 5-24, the drive will maintain the operating frequency and direction of last stage after completing one cycle of operation.

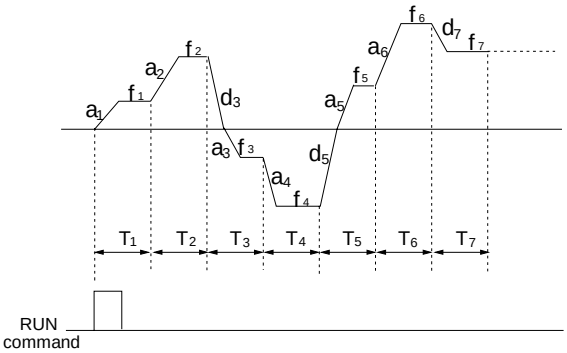


Figure 5-24 Maintaining the frequency after single cycle

3 (continuous operation): See Figure 5-25, the drive will start next cycle of operation automatically after completing one cycle of operation until receiving STOP command.

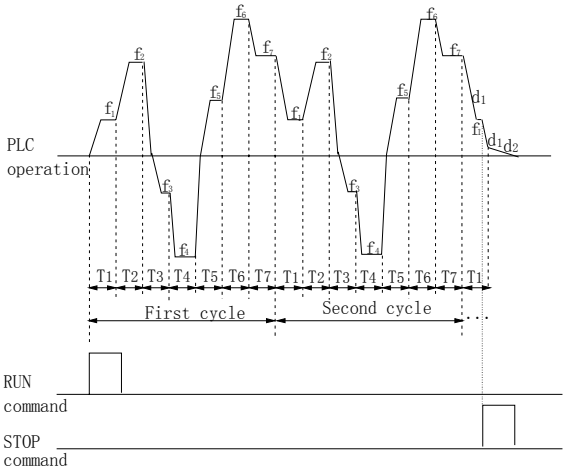


Figure 5-25 Continuous operation of PLC

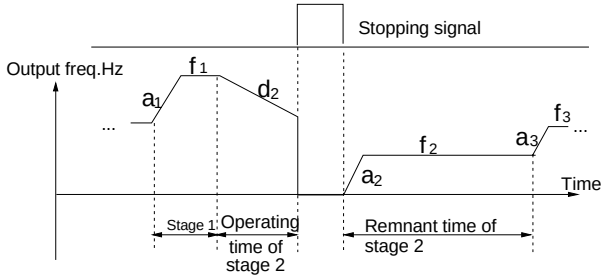
Tens' place: Restart after PLC operation pause

0: Operate from first section

If the drive stops during PLC operation due to receiving STOP command, fault or power failure, it will run from the first stage after restarting.

1: Continue from the stage where the drive stops

When the drive stops during PLC operation due to receiving STOP command or fault, it will record the operating time and will continue from the stage where the drive stops after restart at the frequency defined for this stage, as shown in Figure 5-26.



a1: Acc time of stage 1
a3: Acc time of stage 3
f1: Freq. of stage 1
f3: Freq. of stage 3
a2: Acc time of stage 2
d2: Dec time of stage 2
f2: Freq. of stage 2

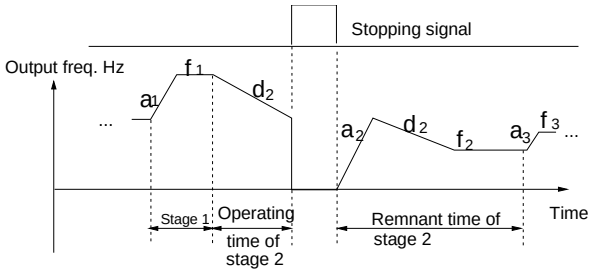
Figure 5-26 PLC start mode 1

2: Continue to operate at the frequency when the drive stops

When the drive stops during PLC operation due to receiving STOP command or fault, it will record the operating time and the current frequency. It will continue running at the recorded frequency from the stage where it just stops upon restart, as shown in Figure 5-27.

Note

The difference between mode 1 and mode 2 is that in mode 2, the drive can record the operating frequency when the drive stops and will run at the recorded frequency after restart.



a1: Acc time of stage 1
a3: Acc time of stage 3
f1: Freq. of stage 1
f3: Freq. of stage 3
a2: Acc time of stage 2
d2: Dec time of stage 2
f2: Freq. of stage 2

Figure 5-27 PLC starting mode 2

Hundred's place: Store the PLC status after power failure

0: Not save

The drive does not save the PLC operating status after power failure and start operating in first stage after restart.

1: Save

Memorize the operating parameters of PLC operation after power failure, including the operating stage, operating frequency, and operating time. The drive will continue to operate in the mode defined by the ten's place.

Thousand's place: time unit

0: Second

1: Minute

This unit is only valid for defining the PLC operating time. The unit of Acc/Dec time in PLC operation is determined by F9.09.

Note

1. The stage is ineffective if the time of this stage of PLC operation is set to 0.

2. You can use terminals to pause and disable PLC operation, and clear the memorized parameters. See the introductions to group F7 parameters.

F4.01 Stage 1 setting	Range: 000~323【000】
F4.02 Time of stage 1	Range: 0~6500s(min)【20.0s】
F4.03 Stage 2 setting	Range: 000~323【000】
F4.04 Time of stage 2	Range: 0~6500s(min)【20.0s】
F4.05 Stage 3 setting	Range: 000~323【000】
F4.06 Time of stage 3	Range: 0~6500s(min)【20.0s】

F4.07 Stage 4 setting	Range: 000~323【000】
F4.08 Time of stage 4	Range: 0~6500s(min)【20.0s】
F4.09 Stage 5 setting	Range: 000~323【000】
F4.10 Time of stage 5	Range: 0~6500s(min)【20.0s】
F4.11 Stage 6 setting	Range: 000~323【000】
F4.12 Time of stage 6	Range: 0~6500s(min)【20.0s】
F4.13 Stage 7 setting	Range: 000~323【000】
F4.14 Time of stage 7	Range: 0~6500s(min)【20.0s】

F4.01, F4.03, F4.05, F4.07, F4.09, F4.11 and F4.13 are used to configure the operating frequency, direction and Acc/Dec time of each PLC operating stage. These functions are all selected by digits, as shown in Figure 5-28. The 7 stages of PLC can correspond to MS or close loop running.

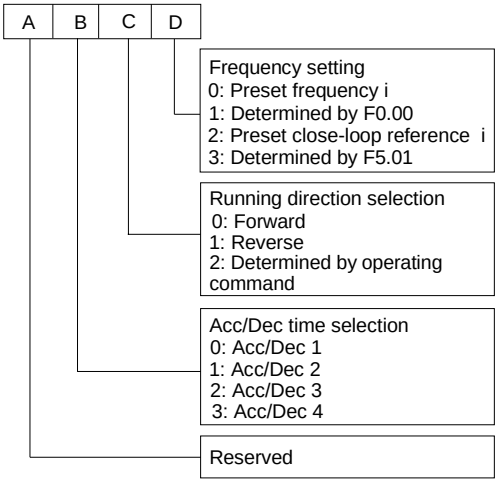


Figure 5-28 Settings of PLC stage I(i=1~7)

Where,

A: thousand's place B: Hundred's place

C: Ten's place D: Unit's place

Units' place for setting stage i:

0: Select preset frequency i, for example: F4.01 sets the parameter of stage 1, so the reference frequency is preset frequency 1 set by F3.23. Please refer to F3.23~F3.29 for definitions of preset frequencies.

1: The frequency is determined by parameter F0.00

2: Preset close-loop reference i, for example: F4.03 sets the parameter of stage 2, so the reference frequency is close-loop frequency 2 set by F5.21. Please refer to F5.20~F5.26 for definitions of preset close-loop reference.

3: Determined by Parameter F5.01

PLC can realize close-loop operation in a certain stage. Close-loop reference selectors can be preset close-loop reference i or determined by parameter F5.01; and the feedback is determined by F5.02. When the reference selector is determined by parameter F5.01, the terminals can be selected via preset close-loop reference. See F7.00~F7.07 and F5.20~F5.26 for details.

Note

When the PLC operating direction is determined by operating commands, the direction of the motor can be controlled by external terminals. For example: to run forward by closing FWD-COM terminal, and run reverse by closing REV-COM. If no command is given, the drive will run in the direction of last stage.

5.6 Close-loop Control Parameters (Group F5)

There are two kinds of close loop control: analog close-loop control (feedback value is analog value) and pulse close-loop control (feedback value is pulse). Figure 5-29 and 5-30 show the typical wiring of analog close-loop control and pulse close-loop control respectively.

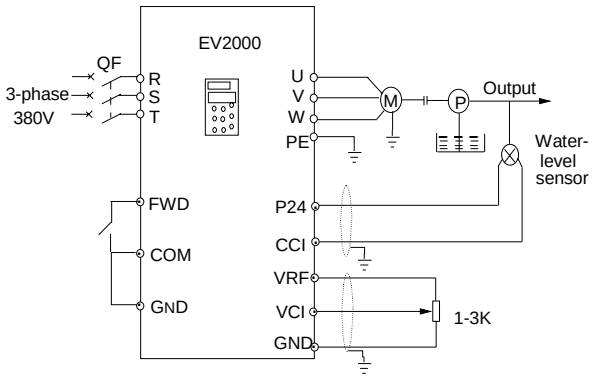


Figure 5-29 Analog feedback control system with internal PI

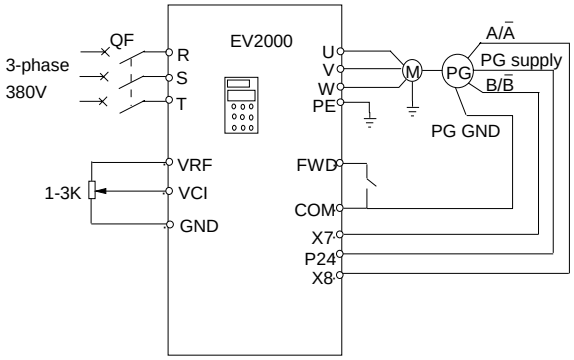


Figure 5-30 Wiring of speed close-loop with PG

Analog feedback control system:

An analog feedback control system uses a water-level sensor as the feedback sensor of the internal PI.

As shown in Figure 5-29, pressure reference (voltage signal) is input via terminal VCI, while the feedback pressure value is input into terminal CCI in the form of 0(4)~20mA current signal. The reference signal and feedback signal are detected by the analog channel. The start and stop of the drive can be controlled by terminal FWD.

The above system can also use a TG (speed measuring generator) in close speed-loop control

Close speed-loop using PG:

A close speed-loop control system uses external control terminals X_7 and X_8, and pulse generator(PG).

As shown in Figure 5-30, reference of speed close-loop can be input by a potentiometer in the form of voltage signal via terminal VCI, while the feedback value of the close loop is input by PG in pulse mode via terminals X7 and X8. The start and stop of the drive can be controlled by terminal FWD.

In Figure 5-30:

A and B are PG's dual phase quadrature output;

P24 is connected to the power source of PG;

Speed reference is the voltage signal of 0~10V. The voltage signal is in direct proportion to synchronous speed n_0 that corresponds to 0~Max frequency (F0.05), and f_{max} is Max frequency (F0.05), and P is the number of poles of motor(FH.00).

$n_0=120\times f_{max}/P$

Refer to F7.00~F7.07 for the functions of input terminals X7 and X8.

Note

1. The reference can also be input via panel or serial port;

2. Dual-phase input is good for improving the speed measurement accuracy, while the wiring of single-phase input circuit is simple;

3. Dual-phase pulse can only be input in quadrature mode;

4. If using the drive's terminal P24 to supply the power to PG, then the Max load current of optical PG must be less than 100mA.

Operating principles of internal PI of EV2000 is shown in the Figure 5-301.

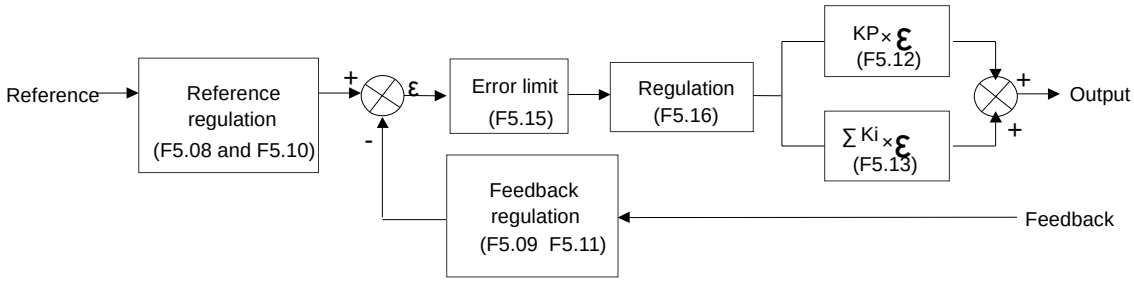


Figure 5-31 PI block diagram

In the above Figure, KP: proportional gain; Ki: integral gain In Figure 5-31, refer to F5.01~F5.15 for the definitions of close-loop reference, feedback, error limit and proportional and Integral parameters.

There are two features of internal PI of EV2000:

The relationship between reference and feedback can be defined by F5.08~F5.11.

For example: In Figure 5-29, if the reference is analog signal of 0~10V, the controlled value is 0~1MP, and the signal of water-level sensor is 4~20mA, then the relationship between reference and feedback is shown in Figure 5-32.

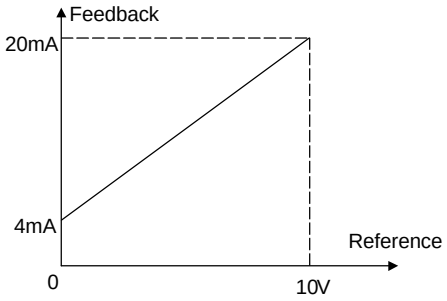


Figure 5-32 Reference and feedback

The reference value is a 0~10V signal (10V corresponds to 100%); and the feedback value is 4Ma~20mA (20mA corresponds to 100%).

In Fig 5-31, "reference regulation" and "feedback regulation" mean that the reference value and feedback value are converted from current or voltage value to percentage values, so that feedback value can be added to or subtracted from the reference value.

Close-loop reference is selected via F5.16 to satisfy different application requirements.

If the motor's speed is required to increases with the reference speed, this kind of control characteristic is called positive characteristic. If the motor speed is required to decrease when the reference value increases, this control characteristic is called negative characteristic.

Please refer to Figure 5-33 and F5.16.

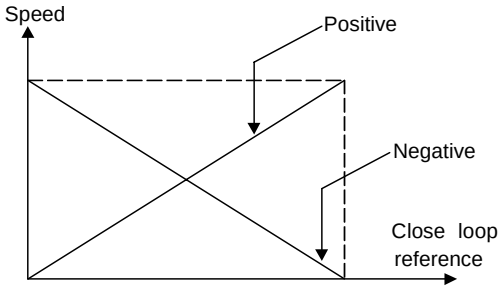


Figure 5-33 Close-loop control characteristic

After the control type is determined, follow the procedures below to set close loop parameters.

Determine the close-loop reference and feedback channel (F5.01 and F5.02);

The relationship between close-loop reference and feedback value (F5.08~F5.11) should be defined for close-loop control;

For speed close-loop, the close-loop speed reference and the number of revolutions of PG (F5.06~F5.07) need to be determined;

Determine the close-loop regulation characteristic, i.e. whether the motor speed increase with the reference. Please see F5.16.

Set up the integral regulation function and close-loop frequency presetting function (F5.17~F5.19);

Adjust the close-loop filtering time, sampling cycle, error limit and gain(F5.12~F5.15).

F5.00 Close-loop control function	Range:0. 1【0】

0: disabled

1: enabled

F5.01 Reference selector	Range:0. 1. 2【1】

0: digital input

Take the value of F5.05 (when the setting is analog close-loop, F5.02＝0~5);

Take the value of F5.06 (when the setting is pulse close-loop, F5.02＝6).

1: VCI analog voltage input(0~10V)

2: CCI analog input

Analog input range:0~10V(Jumper CN10 is placed at side V), or 0~20mA(Jumper CN10 is placed at side I).

Note

Use pulse feedback to control the speed. If the reference is analog signal, then 0~10V (4~20mA) reference corresponds to synchronous speed n_0 (n_0 = 120fmax/P).

F5.02 Feedback selector	Range:0~6【1】

0: VCI 0~10V analog voltage input

1: CCI analog input

2: VCI＋CCI

3: VCI-CCI

4: Min {VCI,CCI}

5: Max {VCI,CCI}

Settings of jumper CCI are the same with the above. When current input is selected, the signal will be converted into voltage signal by the formula:

Voltage value = current value (mA)/2;

6: pulse input

Both single-phase PG feedback and dual-phase PG feedback can be used. Refer to the definitions of multi-function input terminal X7 and X8 (functions of F7.06~F7.07).

F5.03 Reference filter	Range:0.01~50.00s【0.50s】
F5.04 Feedback filter	Range:0.01~50.00s【0.50s】

Both the reference signal and feedback signal carry noise. These signals can be filtered by setting the time constant of filter (F5.03 and F5.04). The bigger the time constant, the better the immunity capability, but the response becomes slow. The smaller the time constant, the faster the response, but the immunity capability becomes weak.

F5.05 Digital setting of reference	Range:0.00~10.00V【0.00】

When analog feedback is used (F5.02=0~5), this function can realize digital setting of reference via panel or serial port.

F5.06 Close-loop speed reference	Range:0~39000rpm【0 rpm】

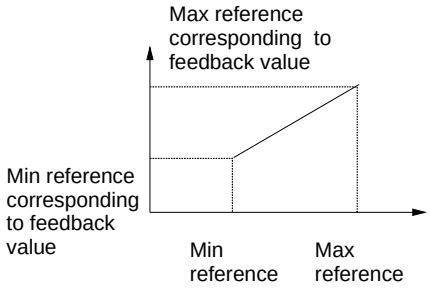
If PG pulse feedback is used (F5.02=6), the speed reference can be set by panel or serial port

F5.07 Number of pulses per revolution of PG	Range:1~9999【1024】

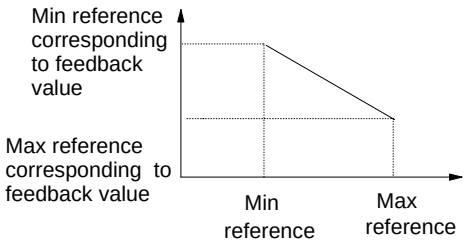
The setting of F5.07 is determined by the parameters of PG.

F5.08 Min reference	Range:0.0%~ F5.10【0.0%】
F5.09 Feedback value corresponding to the Min reference	Range:0.0~ 100.0% 【20.0%】
F5.10 Max reference	Range:F5.08~ 100.0% 【100.0%】
F5.11 Feedback value corresponding to the Max reference	Range:0.0~ 100.0% 【100.0%】

F5.08~F5.11 define the relationship between the close-loop reference and feedback value. The setting is the ratio (percentage value) of input and feedback value to reference (10V or 20mA).


Max reference corresponding to feedback value
Min reference corresponding to feedback value
Min reference
Max reference

(1) positive regulation of feedback


Min reference corresponding to feedback value
Max reference corresponding to feedback value
Min reference
Max reference

(2) negative regulation of feedback

Figure 5-34 Relationship between feedback and reference

F5.12 Proportional gain K_P	Range:0.000~9.999【0.050】
F5.13 Integral gain Ki	Range:0.000~9.999【0050】
F5.14 Sampling cycle T	Range:0.01~50.00s【0.50s】

The bigger the proportional gain of K_P, the faster the response, but oscillation may easily occur.

If only proportional gain K_P is used in regulation, the error cannot be eliminated completely. To eliminate the error, please use the integral gain Ki to form a PI control system. The bigger the Ki, the faster the response, but oscillation may easily occur if Ki is too big.

The sampling cycle T refers to the sampling cycle of feedback value. The PI regulator calculates once in each sampling cycle. The bigger the sampling cycle the slower the response.

F5.15 Error limit	Range:0.0~20%【2.0%】

It defines the max. deviation of the output from the reference, as shown in Figure 5-35. PI regulator stops operation when the feedback value is within this range. Setting this parameter correctly is helpful to improve the system output accuracy and stability.

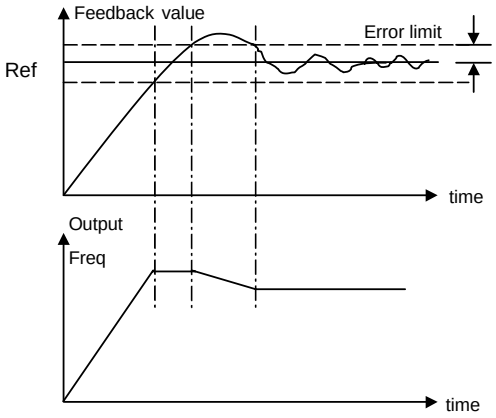


Figure 5-35 Error limit

F5.16 Close-loop regulation characteristic	Range:0. 1【0】

0: Positive

Set F5.16 to 0 if the motor speed is required to be increased with the increase of the reference.

1: Negative

Set F5.16 to 1 if the motor speed is required to decrease with the increase of the reference.

F5.17 Integral regulation selection	Range:0. 1【0】

0: Stop integral regulation when the frequency reaches the upper and lower limits

1: Continue the integral regulation when the frequency reaches the upper and lower limits

It is recommended to disable the integral regulation for the system that requires fast response.

F5.18 Preset close-loop frequency	Range:0.00~650.00Hz【0.00Hz】
F5.19 Holding time of preset close-loop frequency	Range:0.0~3600s【0.00s】

This function can make the close-loop regulation enter stable status quickly.

When the close-loop function is enabled, the frequency will ramp up to the preset close-loop frequency (F5.18) within the Acc time, and then the drive will start close-loop operation after operating at the preset frequency for certain time(defined by F5.19).

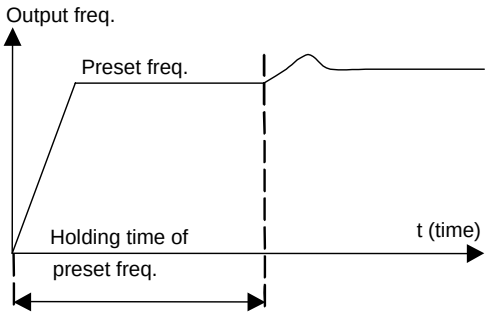


Figure 5-36 Preset frequency of close-loop operation

Note

You can disable the function by set both F5.18 and F5.19 to 0.

F5.20 Preset close-loop reference 1	Range:0.0~10.00V【0.00V】
F5.21 Preset close-loop reference 2	Range:0.0~10.00V【0.00V】
F5.22 Preset close-loop reference 3	Range:0.0~10.00V【0.00V】
F5.23 Preset close-loop reference 4	Range:0.0~10.00V【0.00V】
F5.24 Preset close-loop reference 5	Range:0.0~10.00V【0.00V】
F5.25 Preset close-loop reference 6	Range:0.0~10.00V【0.00V】
F5.26 Preset close-loop reference 7	Range:0.0~10.00V【0.00V】

Among the close-loop reference selectors, besides the 3 selectors defined by F5.01, the voltage value defined by F5.20~F5.26 can also be used as the close-loop reference.

Voltage of preset close-loop reference 1~7 can be selected by terminals, refer to introductions to F7.00~F7.07 for details. These functions can also be used in conjunction with PLC operating functions, see introductions to group F4 parameters for details.

The priority preset close-loop reference control is higher than the reference selectors defined by F5.01.

5.7 Traverse Operating Parameters (Group F6)

Traverse operation is widely used in textile and chemical fiber industry. The typical application is shown in Figure 5-37.

Traverse operation process: First, the drive accelerates to the preset frequency of traverse operation (F6.02) within the Acc time and then waits for certain time (F6.03). The drive transits to the central frequency within Acc/Dec time, and at last the drive traverse according to the preset traverse amplitude (F6.04), jitter frequency(F6.05), traverse cycle(F6.06) and rising time of traverse operation (F6.07) until it receives a stopping command and stops within Dec time.

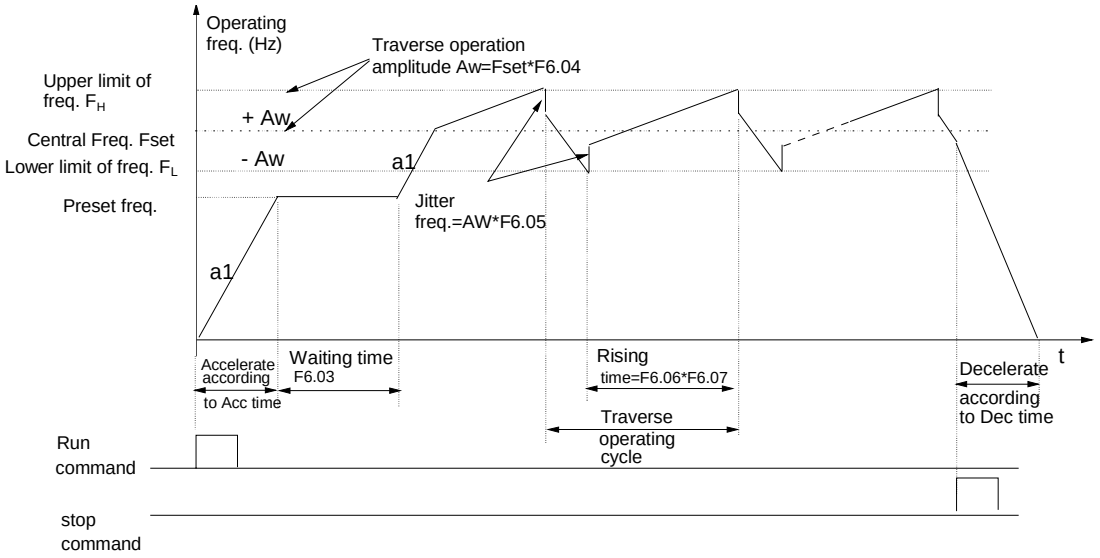


Figure 5-37 Traverse operation

The central frequency is actually the preset frequency of simple operation (except PLC, traverse operation, jog), multi-step speed operation or PLC operations;

Traverse operating function is disabled automatically in Jog operation or close-loop operation process.

If PLC operation and traverse operation start at the same time, the traverse operation is disabled when the drive transits from one PLC operating stage to another stage. The drive will accelerate to the preset frequency of PLC operation and then start traverse operation. The drive will decelerate to stop within the Dec time set in PLC operating stage.

F6.00 Traverse function selection	Range:0~1【0】

F6.00 decides whether the traverse operating function is enabled

0: disabled

1: enabled

F6.01 Traverse operating mode	Range:0000~1111【0000】

F6.01 is used to set the traverse operating mode and the meanings of LED display are shown in Figure 5-38.

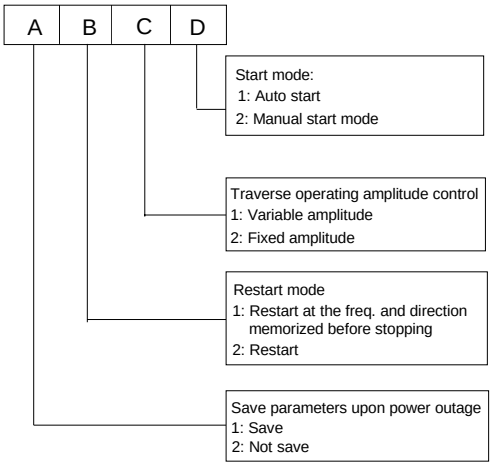


Figure 5-38 Traverse operating mode

Where,

A: thousand's place B: Hundred's place

C: Ten's place D: Unit's place

Unit's place: start mode

0: auto mode

The drive will first operate at preset frequency of traverse operation (F6.02) for certain time (F6.03), and then enter traverse mode automatically.

1: Manual mode

If the multi-function terminal (Xi is set to No.33 function) is enabled, the drive will enter traverse mode. If the terminal is disabled, the drive will end traverse operation and operate at the pre-traverse frequency (F6.02).

Ten's place: traverse operating amplitude

0: variable amplitude

Traverse operating amplitude AW changes with the central frequency and the change rate is defined by F6.04.

1: Fixed amplitude

Traverse operating amplitude AW is determined by Max frequency and F6.04.

Hundred's place: start mode of traverse operation

0: The drive starts and runs at the frequency and direction before it stops

1: Restart

Thousand's place: saving the traverse operating parameters upon power outage

The traverse operating parameters can be saved when power outage occurs. The function is effective when the hundred's place is set at 0.

0: save

1: not save

Note

Terminal Xi (No. 34 function) can be used to reset the traverse operating status.

F6.02 Pre-traverse frequency	Range: 0.00Hz~650.0Hz 【0.00Hz】
F6.03 Holding time of Pre-traverse frequency	Range:0.0~3600.0s【0.0s】

F6.02 is used to define the drive's operating frequency before entering traverse mode.

If auto-start mode is selected, F6.03 is used to define the time when the drive operates at pre-traverse frequency. If manual start mode is selected, F6.03 is disabled.

Refer to Figure 5-37.

F6.04 Traverse amplitude	Range:0.0~50.0%【0.0%】

variable amplitude: AW = central frequency × F6.04

Fixed amplitude: AW = Max operating frequency F0.05×F6.04

Note

The traverse operating frequency is restricted by the upper and lower limit of frequency. Traverse operation will be abnormal if the frequency is set incorrectly.

F6.05 Jitter frequency	Range:0.0~50.0%(ratio to amplitude) 【0.0%】

As shown in Figure 5-37, there is no jitter frequency if F6.05 is set to 0.

F6.06 Traverse operating cycle	Range:0.1~999.9s【10.0s】

F6.06 defines a complete cycle of traverse operation including rising and falling processes.

Note

In traverse mode, do not select auto Acc/Dec operating mode, otherwise the traverse operating cycle will be abnormal.

F6.07 Rising time of triangle wave	Range:0~100.0%【50.0%】

Rising time of traverse operation＝F6.06×F6.07.

Falling time of traverse operation＝F6.06×(1-F6.07)

The unit is second. Refer to Figure 5-37.

Note

You can select traverse mode and S curve at the same, thus the traverse operation is much more smoother.

5.8 Terminal Function (Group F7)

F7.00 Multi-function terminal X1	Range:0~43【0】
F7.01 Multi-function terminal X2	Range:0~43【0】
F7.02 Multi-function terminal X3	Range:0~43【0】
F7.03 Multi-function terminal X4	Range:0~43【0】
F7.04 Multi-function terminal X5	Range:0~43【0】
F7.05 Multi-function terminal X6	Range:0~43【0】
F7.06 Multi-function terminal X7	Range:0~47【0】
F7.07 Multi-function terminal X8	Range:0~48【0】

The functions of multi-function input terminal X1~X8 are extensive. You can select functions of X1~X8 according to your application by setting F7.00~F7.07. Refer to Table 5-5.

Table 5-5 Multi-function selection

Setting	Functions
0	No function
1	Preset frequency 1
2	Preset frequency 2
3	Preset frequency 3
4	Acc/Dec time 1
5	Acc/Dec time 2
6	External fault signal normally-open input
7	External fault signal normally-close input
8	RESET signal
9	Forward jog operation
10	External terminals for reverse jog operation
11	Coast-to-stop(FRS)
12	Frequency ramp up (UP)
13	Frequency ramp down(DN)
14	Pause the PLC operation
15	Acc/Dec prohiBit
16	3-wire operation control
17	External interrupt signal normally-open input
18	External interrupt signal normally-close input
19	DC injection braking command (DB)
20	Close-loop disabled
21	PLC disabled
22	Frequency selector 1
23	Frequency selector 2
24	Frequency selector 3
25	Frequency reference is input via terminal CCI forcibly
26	Reserved
27	Terminal control mode is forcibly enabled
28	Control mode selector 1
29	Control mode selector 2
30	Preset close-loop reference 1
31	Preset close-loop reference 2
32	Preset close-loop reference 3

Setting	Functions
33	Start traverse operation
34	Reset the traverse operating status
35	External stop command
36	Reserved
37	Drive operation prohiBiting
38	Reserved
39	Length clearing
40	Auxiliary reference frequency clearing
41	Reset PLC stopping status
42	Counter's zero-clearing signal input
43	Counter's trig signal input
44	Input the signal of length
45	Pulse input
46	Single-phase speed measuring input
47	Speed measuring input SM1(only set for X7)
48	Speed measuring input SM2(only for X8)

Introductions to functions listed in Table 5-5:

1~3: setting speed reference

Up to 8 speed references can be set through different ON/OFF combinations of terminals K_3, K_2 and K_1.

Table 5-6 On/Off combinations of terminals

K_3	K_2	K_1	Frequency setting
OFF	OFF	OFF	Common operating frequency
OFF	OFF	ON	Preset frequency 1
OFF	ON	OFF	Preset frequency 2
OFF	ON	ON	Preset frequency 3
ON	OFF	OFF	Preset frequency 4
ON	OFF	ON	Preset frequency 5
ON	ON	OFF	Preset frequency 6
ON	ON	ON	Preset frequency 7

The frequency references will be used in MS speed operation and simple PLC operation. Take MS speed operation for example:

Definitions of terminals X1, X2 and X3:

After setting F7.00 to 1, F7.01 to 2 and F7.03 to 3, terminals X1, X2 and X3 can be used in MS speed operation, as shown in Figure 5-39.

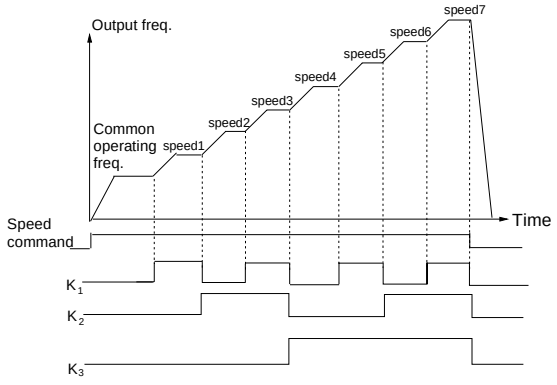


Figure 5-39 Multi-step speed operation

In Figure 5-40, terminal control is selected. The operating direction can be controlled by K_4 and K_5. Common operating frequency and preset frequency 1~7 can be selected through different On/Off combinations of K_1, K_2 and K_3.

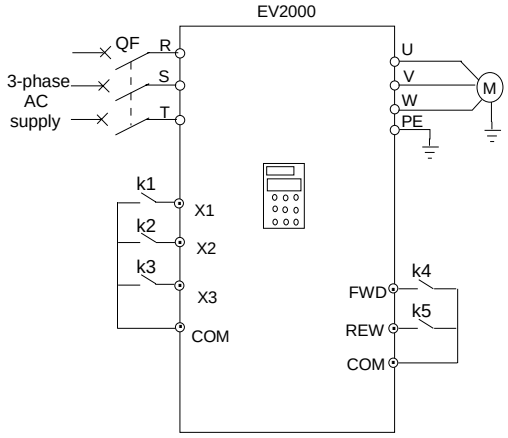


Figure 5-40 Wiring for multi-speed operation

4~5: selecting Acc/Dec time

Table 5-7 Acc/Dec time selection

Terminal 2	Terminal 1	Acc/Dec time selection
OFF	OFF	Acc time 1/Dec time 1
OFF	ON	Acc time 2/Dec time 2
ON	OFF	Acc time 3/Dec time 3
ON	ON	Acc time 4/Dec time 4

Through the On/Off combinations of terminals, Acc/Dec time 1~4 can be selected.

6~7: inputting external fault signal (normally-open/close input)

If the setting is 6~7, the fault signal of external equipment can be input via the terminal, which is convenient for the drive to monitor the external equipment. Once the drive receives the fault signal, it will display "E015". The fault signal has two inputting modes: normally-open and normally-close input.

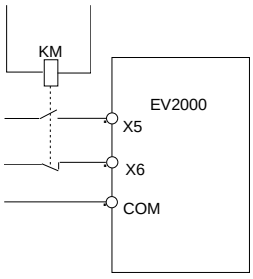


Figure 5-41 Normally-open/close input

As shown in Figure 5-41, X_5 is normally-open contact and X_6 is normally-close command. KM is the relay for inputting external fault signal.

8: inputting external reset signal

If the setting is 8, the drive can be reset via this terminal when the drive has a fault. The function of this terminal is the same with that of RESET on the panel.

9~10: inputting jog operation signal (JOGF/JOGR)

If the setting is 9~10, this terminal can enable jog operation. JOGF is for inputting forward jog command and JOGR is for reverse jog command. Jog frequency, interval and Acc/Dec time of jog operation are defined in F3.13~F3.16.

11: Coast-to-stop

If the setting is 11, the function of the terminal is the same with that defined by F2.08. It is convenient for remote control.

12~13: Frequency ramp UP/DN

If the setting is 12~13, the terminal can be used to increase or decrease frequency. Its function is the same with ▲ and ▼ keys on the panel, which enables remote control. This terminal is enabled when F0.00=1 or F9.01=2. Increase or decrease rate is determined by F7.09.

14: pausing PLC operation:

If the setting is 14, the terminal is used to pause the PLC operation and the drive operates at zero frequency when the terminal is enabled. There is no timing of PLC operation. If the terminal is disabled, the drive will start on the fly and continue the PLC operation. Refer F4.00~F4.14 to how to use this terminal.

15: Acc/Dec prohibiting command

If the setting is 15, the terminal can make the motor operate at present speed without being influenced by external signal (except stopping command).

Note

This terminal is disabled in normal Dec-to-stop process.

16: 3-wire operation control.

Refer to F7.08, operation mode 2 and 3 (3-wire operation mode 1 and 2).

17~18: inputting external stopping signal (Normally-open/close input)

During operating, the drive stops its output and operates at zero frequency when it receives external STOP signal. Once the signal is removed, the drive will start on the fly and resume normal operation.

There are two inputting modes of external stopping signal: normally-open and normally-close input. As shown in Figure 5-41, X_5 is normally-open contact and X_6 is normally-close contact.

Note

Different with No. 6~7 functions, the external stopping signal will not trigger alarm and the drive can resume normal operation after the signal is removed.

19: DC injection braking signal

If the setting is 19, the terminal can be used to perform DC injection braking to the motor that is running so as to realize the emergent stop and accurate location of the motor. Initial braking frequency, braking delay time and braking current are defined by F2.09~F2.11. Braking time is the greater value between F2.12 and the effective continuous time defined by this control terminal.

20: disabling close-loop function

If the setting is 20, the terminal can be used to realize the flexible switching between close-loop operation and low level operating mode (refer to section 4.1.4 for details).

Note

The switching between operation modes is enabled only in close-loop operation (F5.00=1).

When the drive is switched to low level operating mode, its start/stop, operating direction, ACC/Dec time should be compliant with corresponding operating modes.

21: disabling PLC

If the setting is 21, the terminal is used to realize the flexible switching between PLC operation and low level operating mode (refer to section 4.1.4 for details).

Note

The switching between operation modes can be enabled only in PLC operation (unit's place of F4.00 is not 0).

When the drive is switched to low level operating mode, its start/stop, operating direction, ACC/Dec time should be compliant with corresponding operating modes accordingly.

22~24: Terminals 1~3 for reference frequency selector.

Different ON/OFF combinations of terminals 1, 2 and 3 can select different reference frequency selectors as shown in Table 5-8. The drive will act to the command from the terminal or F0.00, whichever comes late.

Table 5-8 Frequency selector

Terminal 3	Terminal 2	Terminal 1	Freq. selector
OFF	OFF	OFF	Hold the setting
OFF	OFF	ON	Digital setting 1
OFF	ON	OFF	Digital setting 2
OFF	ON	ON	Digital setting 3
ON	OFF	OFF	VCI analog input
ON	OFF	ON	CCI analog input
ON	ON	OFF	PULSE terminal input
ON	ON	ON	PULSE terminal input

25:Frequency reference is input via terminal CCI forcibly

If the setting is 25, the frequency reference will be input via terminal CCI forcibly. The frequency selector will be changed to the previous one if this terminal function is disabled.

26:Reserved

27: Terminal control mode is forcibly enabled

When this terminal function is enabled, the operating command is input through this terminal forcibly, and the drive will be controlled in previous control mode if FWD/REV terminal function is disabled.

28~29: On/Off combinations of terminals 1 and 2 for different control modes selection

Table 5-9 Control modes

Terminal 2	Terminal 1	Control modes
OFF	OFF	Hold the control mode
OFF	ON	Panel control mode
ON	OFF	Terminal control mode
ON	ON	Serial port control mode

The control modes in Table 5-9 can be selected by the different On/Off combinations of terminals 1 and 2.

30~32: Selecting preset close-loop reference frequencies via On/Off combinations of terminals 1~3.

Table 5-10 Preset close-loop reference selection

Terminal 3	Terminal 2	Terminal 1	Preset close-loop reference selection
OFF	OFF	OFF	Close-loop reference is decided by F5.01
OFF	OFF	ON	Preset close-loop reference 1
OFF	ON	OFF	Preset close-loop reference 2
OF	ON	ON	Preset close-loop reference 3
ON	OFF	OFF	Preset close-loop reference 4
ON	OFF	ON	Preset close-loop reference 5
ON	ON	OFF	Preset close-loop reference 6
ON	ON	ON	Preset close-loop reference 7

The preset close-loop references in Table 5-10 can be selected by the different On/Off combinations of terminals 1~3.

33: Start traverse operation

When the traverse operation is set to “manual start”, the traverse function can be enabled if this terminal is enabled, see Group F6 parameters for details.

34: Reset the traverse operating status

If traverse operation is enabled, switching on this terminal can clear the memorized information about traverse operation no matter the drive is in auto start or manual start mode. Traverse operation restarts after this terminal is disconnected. See group F6 parameters.

35: external stopping command

This stopping command is active in all control modes. When terminal 35 is enabled, the drive will stop in the mode defined in F2.08.

36: Reserved

37: disabling the drive’s operation

If terminal 37 is enabled, the drive that is operating will coast to stop and is prohibited to restart. This function is mainly used in application with requirements of safety protection.

38: Reserved

39: Clear the length information

When terminal 39 is enabled, the setting (length) of F9.15 will be cleared to zero.

40: Clear the setting of auxiliary reference frequency

This function is only active for auxiliary reference frequency (F9.01=1, 2 and 3). When terminal 40 is enabled, the auxiliary frequency is cleared to zero and the reference is determined by main reference frequency.

41: Reset the stopping status of PLC operation

In stopping status of PLC operation, the memorized PLC operating information (operating stage, operating time, operating frequency, etc.) will be cleared when this terminal is enabled. See Group F4 parameters.

42: clearing the counter to zero

When the setting is 42, this terminal is used to clear the counter to zero in conjunction with terminal 43.

43: inputting triggering signal to counter

When the setting is 43, this terminal is used to input pulse signal to the internal counter of the drive. The highest pulse frequency is 200Hz. The present counting value can be saved at power off. See F7.33 and F7.34 for details.

44: inputting counting value of length

Only multi-function input terminals X7 and X8 can be used for this function. The terminal is used in fixed-length control and calculating the length via pulses. See F9.14~F9.19 for details.

45: inputting pulse signal

Only multi-function input terminals X7 and X8 can be used as this function. The terminal is used to input pulse signal as frequency reference. See Group F1 parameters for the relationship between input pulse frequency and the reference frequency.

46: Single-phase speed measuring input

Only multi-function input terminals X7 and X8 can be used as this function. See section 3.3.2. The speed control accuracy is ± 0.1%. Single-phase speed feedback control can be realized by using this terminal and PG.

47: Speed measuring input SM1

48: Speed measuring input SM2

Only multi-function input terminals X7 and X8 can be used as this function. See section 3.3.2. The speed control accuracy is ± 0.1%. Dual-phase speed feedback control can be realized by using this terminal and PG.

Note

When the drive is performing motor auto-tuning, No. 44~47 functions of X7 are disabled automatically.

F7.08 FWD/REV operating modes setup	Range:0~3【0】

This parameter defines four operating modes controlled by external terminals.

0: 2-wire operating mode 1

K_2	K_1	Running command
0	0	Stop
1	0	Run reverse
0	1	Run forward
1	1	Stop

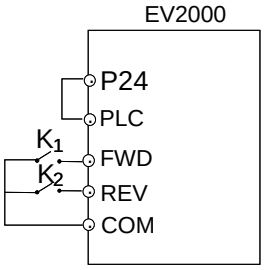


Figure 5-42 2-wire operating mode 1

1: 2-wire operating mode 2

K_2	K_1	Running command
0	0	Stop
1	0	Stop
0	1	Run forward
1	1	Run reverse

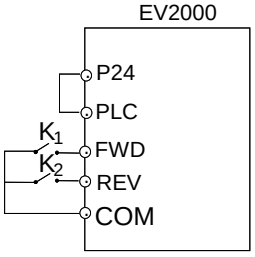


Figure 5-43 2-wire operating mode 2

2: 3-wire operating mode 1

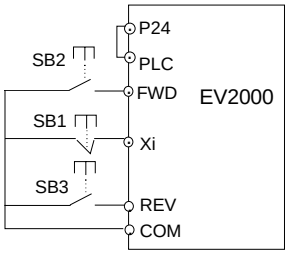


Figure 5-44 3-wire operating mode 1

Where:

SB1: Stop button

SB2: Run forward button

SB3: Run reverse button

Terminal Xi is the multi-function input terminal of X_1~X_8. At this time, the function of this terminal should be defined as No.16 function of “3-wire operation”.

3: 3-wire operation mode 2

K	Running direction
0	Forward
1	Reverse

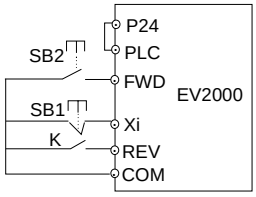


Figure 5-45 3-wire operating mode 2

Where:

SB1: Stop button

SB2: Run button

Terminal Xi is the multi-function input terminal of X_1~X_8. At this time, the function of this terminal should be defined as No.16 function of “3-wire operation”.

Note

In terminal control mode, for 2-wire operating mode 1 and 2, although the terminal is enabled, the drive will not run forward or reverse when the drive stops due to the STOP command from terminal function 11 or 35 (see F7.00~F7.07), PLC stop after single cycle, stop due to the arrival of fixed length, pressing STOP key. If you need to start the drive again, enable FWD/REV again. However, when the drive stops due to a fault, it will start immediately if the terminal FWD/REV is enabled and the fault is cleared.

F7.09 UP/DN rate	Range:0.01~99.99Hz/s【1.00Hz/s】

F7.09 is used to define the change rate of reference frequency that is changed by terminal UP/DN.

F7.10 Bi-direction open-collector output terminal Y1	Range:0~19【0】
F7.11 Bi-direction open-collector output terminal Y2	Range:0~19【1】
F7.12 Output functions of relay	Range:0~19【16】

Refer to section 3.3.2 for the output characteristics of Y1 and Y2 that are bi-direction open-collector output terminal and the relay’s output terminal. Table 5-11 shows the functions of the above 3 terminals. One function can be selected repeatedly.

Table 5-11 Functions of output terminals

Setting	Function
0	Drive running signal (RUN)
1	Frequency arriving signal (FAR)
2	Frequency detection threshold (FDT1)
3	Frequency detection threshold (FDT2)
4	Overload signal (OL)
5	Low voltage lock-up signal (LU)
6	External stopping command (EXT)
7	High limit of frequency (FHL)
8	Lower limit of frequency (FLL)
9	Zero-speed running
10	Completion of simple PLC operation
11	PLC cycle completion indication
12	preset counting value arriving
13	specified counting value arriving
14	preset length arriving indication
15	drive ready (RDY)
16	Drive fails
17	Extended function 1 of host
18	Upper and lower limits of traverse operating frequency
19	Preset operating time out

In Table 5-11:

0: Drive running signal (RUN)

When the drive is in operating status, there will be running indication signal output by this terminal.

1: Frequency arriving signal (FAR)

See F7.13.

2: Frequency detection threshold (FDT1)

See F7.14~F7.15.

3: Frequency detection threshold (FDT2)

See F7.16~F7.17.

4: Overload signal (OL)

The terminal outputs the indicating signal if the drive's output current is higher than the value defined by FL.05 and the overload time is longer than the time defined by FL.06. This function is usually used in overload pre-alarm. See Figure 5-74.

5: Low voltage lock-up signal (LU)

The terminal outputs the indicating signal if the DC bus voltage is lower than the low voltage limit, and the LED displays "P.oFF".

6: External stopping command (EXT)

The terminal outputs the indicating signal if the drive outputs tripping signal caused by external fault (E015).

7: High limit of frequency (FHL)

The terminal outputs the indicating signal if the preset frequency is higher than upper limit of frequency and the operating frequency reaches the upper limit of frequency.

8: Lower limit of frequency (FLL)

The terminal outputs the indicating signal if the preset frequency is higher than lower limit of frequency and the operating frequency reaches the lower limit of frequency.

9: Zero-speed running

The terminal outputs the indicating signal if the drive's output frequency is 0 and the drive is in operating status.

10: Completion of simple PLC operation stages

The terminal outputs the indicating signal (pulse signal, 500ms width) if the present stage of PLC operation is finished.

11: PLC cycle completion indication

The terminal outputs the indicating signal (signal pulse, 500ms width) if one cycle of PLC operation is finished.

12: preset counting value arriving

13: reference length arriving indication

Refer to F7.33~F7.34 for terminals 12 and 13.

14: preset length arrival indication

The terminal outputs the indicating signal if the actual length defined by F9.15 is longer than the length defined by F9.14. Function of terminal X1~X8 should be set to No.44 function.

15: drive ready (RDY)

If RDY signal is output, it means the drive has no fault, its DC bus voltage is normal and it can receive starting command.

16: Drive fails

The terminal outputs the indicating signal if the drive has faults.

17: extended function 1 of host

The output signal of terminal Y1, Y2 or TC is directly controlled by a serial port. Refer to the communicating protocol of EV2000.

18: Upper and lower limits of traverse operating frequency

If traverse operating function is selected, an indicating signal will be output if the traverse operating frequency calculated by central frequency is higher than upper limit of frequency (F0.12) or lower than the lower limit of frequency (F0.13), as shown in Figure 5-46.

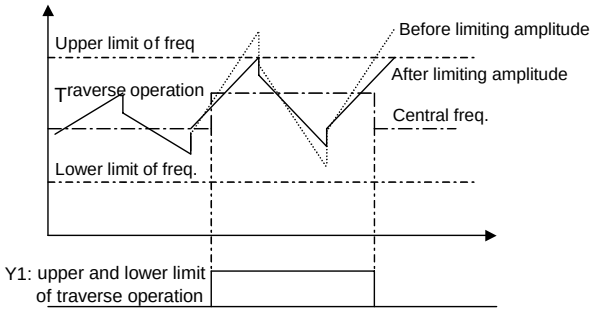


Figure 5-46 Traverse operating amplitude control

19: preset operating time out

The terminal outputs the indicating signal if the drive's total operating time (Fn.01) reaches preset operating time (Fn.00).

F7.13 Frequency arriving signal (FAR)	Range:0.00~650.00Hz 【2.50Hz】

As shown in Figure 5-47, if the drive's output frequency is within the detecting range of preset frequency, a pulse signal will be output.

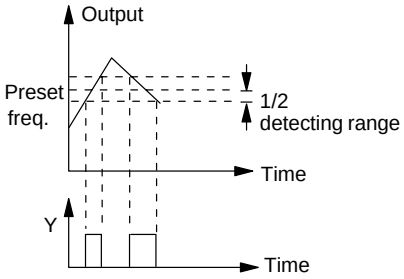


Figure 5-47 Frequency arriving signal

F7.14 FDT1 level	Range: 0.00~650.00Hz【50.00Hz】
F7.15 FDT1 lag	Range: 0.00~650.00Hz【1.00Hz】
F7.16 FDT2 level	Range: 0.00~650.00Hz【25.00Hz】
F7.17 FDT2 lag	Range: 0.00~650.00Hz【1.00Hz】

F7.14~F7.15 is a complement to the No.2 function in Table 5-11. F7.16~F7.17 is a complement to the No.3 function in Table 5-11. Their functions are the same. Take F7.14~F7.15 for example: when the drive's output frequency reaches a certain preset frequency (FDT1 level), it outputs an indicating signal until its output frequency drops below a certain frequency of FDT1 level (FDT1 level-FDT1 lag), as shown in Figure 5-48.

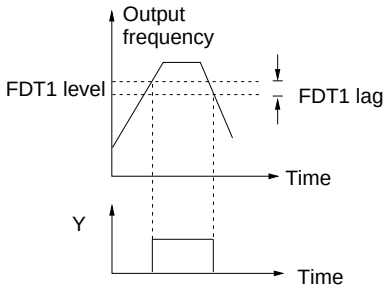


Figure 5-48 FDT level

F7.18~F7.25	Reserved

F7.26 Functions of terminal AO1	Range:0~11【0】
F7.27 Functions of terminal AO2	Range:0~11【3】
F7.28 Functions of terminal DO	Range:0~11【0】

AO1 and AO2 are analog output terminals, and DO is pulse output terminals.

Refer to section 3.3.2 for the output characteristics of AO1 and AO2, their analog output ranges are defined by F7.29.

Pulse frequency range of DO: 0~Max output pulse frequency (defined by F7.32).

The relationship between the displaying range and the output values of AO1, AO2 and DO are given in Table 5-12.

Table 5-12 Displaying range of output terminals

Setting	Functions	Range
0	Output frequency before slip compensation	0~Max output frequency
1	Output frequency after slip compensation	0~Max output frequency
2	Preset frequency	0~Max output frequency
3	Output current	0~2 times of drive's rated current
4	Output current	0~2 times of motor's rated current
5	Output torque	0~2 times of motor's rated torque
6	Output voltage	0~1.2 times of drive's rated voltage
7	Bus voltage	0~800V
8	VCI	0~10V
9	CCI	0~10V/0~20mA
10	Output power	0~2 times of rated power
11	Extended function of host 2	0~65535

If the extended function 2 of host 2 is enabled, the output signal of terminal Y1, Y2 or TC is directly controlled by a serial port. "65535" corresponds to the Max output of 10V(or 20mA). Refer to the communication protocol of EV2000 for details.

For example:

AO1 outputs 4~20mA, which indicates bus voltage 0~800V.

The settings:

①F7.26=7, output bus voltage;

②F7.29=01, output of terminal AO1 is 4~20mA;

③F7.30=100%, output gain is 100%;

④AO1 jumper of CN16 short circuited at 0/4-20mA side.

Note:

If terminal X8 selects functions of 44~46, DO is disabled automatically

F7.29 Analog output range selection	Range:00~11【00】

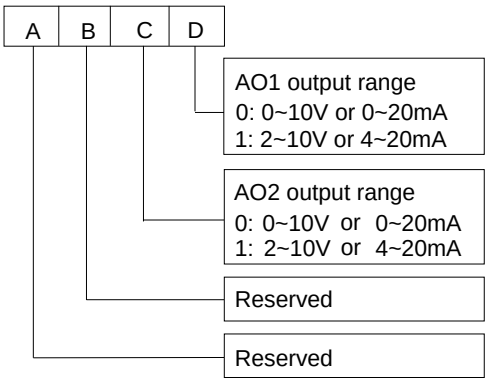


Figure 5-49 analog output offset settings

Where,

A: thousand's place B: Hundred's place

C: Ten's place D: Unit's place

F7.29 is used to select analog output ranges of AO1 and AO2.

F7.30 Output gain of AO1	Range:0.0~200.0%【100.0%】
F7.31 Output gain of AO2	Range:0.0~200.0%【100.0%】

As to the analog output of AO1 and AO2, you can adjust the output gain to change the measuring range or calibrate the meter.

Note

Changing the settings of F7.30 and F7.31 will influence the analog output.

F7.32 Maximum output frequency of DO	Range:0~50.0kHz【10.0KHz】

F7.32 defines the permissible maximum frequency of DO, refer to F7.28.

F7.33 Preset counting value	Range: F7.34~9999【0】
F7.34 Specified counting value	Range: 0~F7.33【0】

F7.33 and F7.34 are complements for No. 12 and 13 functions in Table-5-11.

It defines after Xi receives the number of pulse F7.33, the relay or Yi (bi-direction open-collector output terminal) will give a signal.

For example: as shown in Figure 5-50, when the eighth pulse signal is received by terminal Xi, Y1 outputs an indicating signal. At this time F7.33=8.

When Xi receives the number of pulse F7.34, Yi will give a signal which will last until F7.33 arrives.

As shown in Figure 5-50, when Xi receives the 5th pulse, Y2 outputs an indication signal. It lasts until X1 receives the 8th pulse. In this case, F7.34=5, F7.33=8. F7.34 is invalid if it is bigger than F7.33.

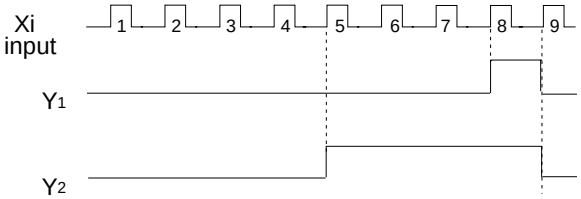


Figure 5-50 Preset and specified pulse number

F7.35 Terminal's positive and negative logic	Range:000~FFFH【000H】

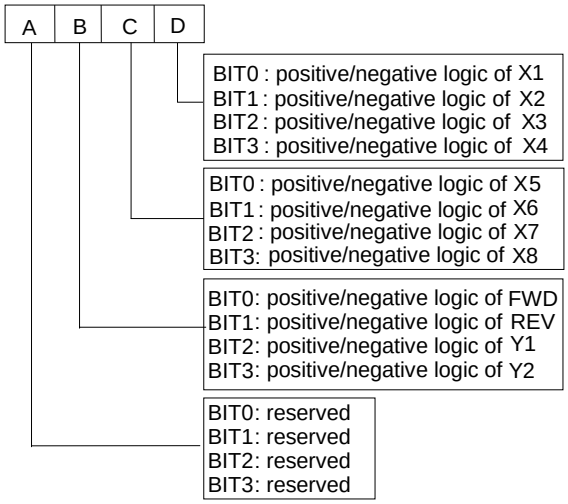

A
B
C
D
BIT0 : positive/negative logic of X1
BIT1 : positive/negative logic of X2
BIT2 : positive/negative logic of X3
BIT3 : positive/negative logic of X4
BIT0 : positive/negative logic of X5
BIT1 : positive/negative logic of X6
BIT2 : positive/negative logic of X7
BIT3: positive/negative logic of X8
BIT0: positive/negative logic of FWD
BIT1: positive/negative logic of REV
BIT2: positive/negative logic of Y1
BIT3: positive/negative logic of Y2
BIT0: reserved
BIT1: reserved
BIT2: reserved
BIT3: reserved

Figure 5-51 terminal's positive and negative logic

Where,

A: Thousand's place B: Hundred's place

C: Ten's place D: Unit's place

F7.35 defines the terminal's positive and negative logic

Positive logic: Terminal Xi is enabled if it is connected to the common terminal;

Negative logic: Terminal Xi is disabled if it is connected to the common terminal;

If the bit is set at 0, it means positive logic; if set at 1, it means negative logic.

For example:

If X1~X8 are required to be positive logic, terminals FWD and REV are required to be negative logic, terminal Y1 is positive logic and terminal Y2 is negative logic, then the settings:

Logic status of X4~X1 is 0000, and the hex value is 0; Logic status of X8~X5 is 0000, and the hex value is 0,; Logic status of Y2, Y1, REV and FWD is 1011, and the hex value is B, so F7.35 should be set at "0B00". Refer to Table 5-13.

Table 5-13 Conversion of binary code and hex value

Binary settings				Hex value
Bit3	Bit2	Bit1	Bit0	(Displaying of LED)
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	A
1	0	1	1	B
1	1	0	0	C
1	1	0	1	D
1	1	1	0	E
1	1	1	1	F

Note

Factory setting of all the terminals is positive logic.

5.9 Display (Group F8)

F8.00 Language selection	Range:0~1【0】

0:Chinese

1:English

F8.00 is effective for the panel with LCD screen.

F8.01 Displayed parameter group 1 during operation	Range:000~3FFH【3FFH】

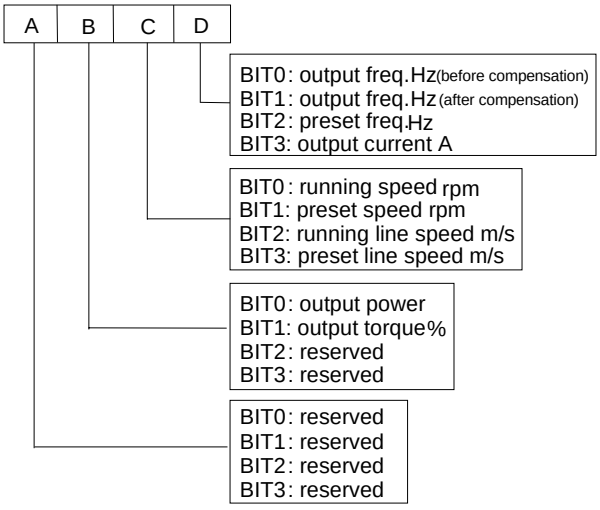


Figure 5-52 LED displayed parameter group 1 in operation

Where,

A: thousand's place B: Hundred's place

C: Ten's place D: Unit's place

F8.01 and F8.02 define the parameters that can be displayed by LED in operating status.

If Bit is 0, the parameter will not be displayed;

If Bit is 1, the parameter will be displayed.

For example, Unit place of LED (Bit0) is to display the "output frequency before compensation", if Bit0=0, the parameter will not be displayed, if Bit0=1, the parameter will be displayed.

See F7.35 for the relationship between the values of each Bit and the displayed value of LED.

F8.02 Displayed parameter group 2 during operation	Range:000~3FFH【000H】

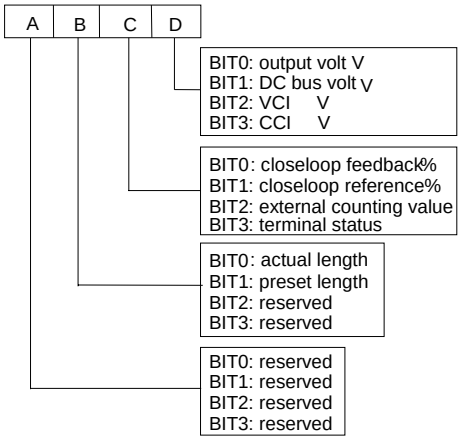


Figure 5-53 Operating parameter 2 displayed by LED

Where,

A: thousand's place B: Hundred's place

C: Ten's place D: Unit's place

The terminal information includes status of terminal X1~X8, bi-direction open-collector output terminals Y1 and Y2, and relay output terminal TC. The status of terminals are indicated by the "On" or "Off' of LED. If the LED turns on, that means the terminal is enabled, and the terminal is disabled if the LED turns off, as shown in Figure5-54:

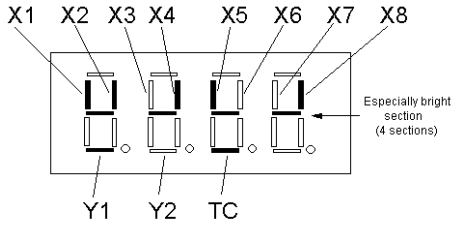


Figure 5-54 Terminal status

In Figure5-54, the LEDs display that terminals X1, X2, X4, X5 and X8 are enabled, terminals X3, X6 and X7 are disabled, terminals Y1 and TC are enabled and terminal Y2 is disabled. The central four LEDs always illuminate for the convenience of observation.

Note

When the rotating speed and line speed are displayed, these values can be revised by pressing ▲ and ▼ directly (no need to switch to frequency displaying status).

When F8.01 and F8.02 are all set to 0, the frequency before compensation will be displayed.

Press ▶▶ key to scroll through the parameters set in F8.02 during operation.

F8.03 Parameters displayed at STOP state	Range:0000~3FFFH【1FFH】

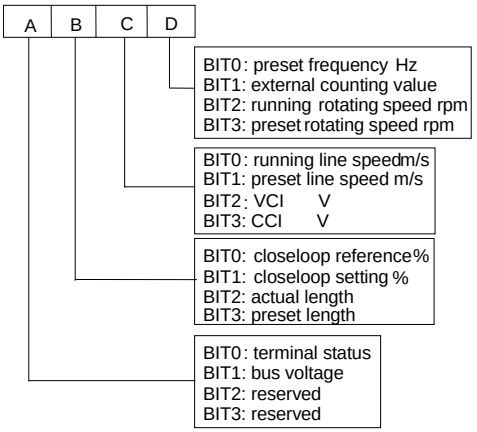


Figure 5-55 Stopping parameters displayed by LED

Where,

A: thousand's place B: Hundred's place

C: Ten's place D: Unit's place

F8.03 defines the parameters that can be displayed by LED in stopping process.

If Bit is 0, the parameter will not be displayed, and if Bit is 1, the parameter will be displayed.

For example, Bit0 decides whether to display the "preset frequency", if Bit0=0, the parameter will not be displayed, if Bit0=1, the parameter will be displayed.

When setting this parameter, see Table 5-13 for conversion of binary code and HEX value.

Note:

When the rotating speed and line speed are displayed, these values can be revised by pressing ▲ and ▼ directly (no need to change to frequency displaying status).

When the setting of F8.03 is 0, the preset frequency will be displayed.

Press ▶▶ key to scroll through the parameters set by F8.03 when the drive stops.

F8.04 Rotating Speed display coefficient	Range:0.1~999.9%【100.0%】

F8.04 is used to correct the error of displayed rotating speed and it has no influence on actual speed.

F8.05 Line speed display coefficient	Range:0.1~999.9%【1.0%】

F8.05 is used to correct the error of displayed line speed and it has no influence on actual speed.

F8.06 Close-loop parameter display coefficient	Range:0.1~999.9% 【100.0%】

F8.06 is used to correct error between actual physical value (pressure or flow) and reference or feedback values (voltage or current). It has no influence on close-loop PI regulation.

5.10 Enhanced Functions (Group F9)

F9.00 Control mode bundled with frequency selector	Range:000~666 【000】

F9.00 can bundle 3 control modes with 6 reference frequency selectors, that is, if a control mode is selected, then a frequency selector (such as panel input, analog VCI input) will be selected automatically.

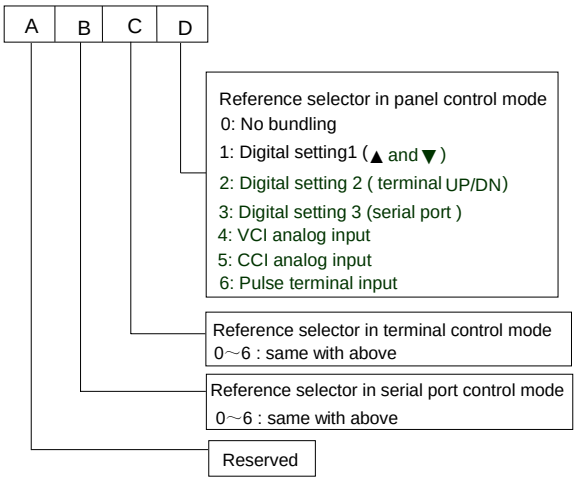

A
B
C
D
Reference selector in panel control mode
0: No bundling
1: Digital setting1 (▲ and ▼)
2: Digital setting 2 (terminal UP/DN)
3: Digital setting 3 (serial port)
4: VCI analog input
5: CCI analog input
6: Pulse terminal input
Reference selector in terminal control mode
0～6 : same with above
Reference selector in serial port control mode
0～6 : same with above
Reserved

Figure 5-56 Control mode is bundled to frequency selector

Where,

A: thousand's place B: Hundred's place

C: Ten's place D: Unit's place

The reference frequency selector is defined by F0.00, see section 5.1 for details.

Different control modes can be bundled to one reference frequency selector.

There are 3 methods to select control modes:

Method 1: change F0.03 "Control modes selector";

Method 2: use PANEL/REMOTE or ENTER/DATA;

Method 3: use the terminals that can select control modes (Functions of terminals X1~X8 should be set to No. 28 and 29 functions.)

For example:

In order to realize remote and local control, it requires that:

①Control modes selection: The control modes can be selected by terminal remotely or by PANEL/REMOTE locally;

②If panel control mode is used, press RUN to run the drive and press STOP to stop the drive. The preset frequency can be adjusted by pressing ▲ and ▼.

③If terminal control mode is used, connect FWD terminal to run forward and connect REV terminal to run reverse. The preset frequency is adjusted via VCI.

④Terminal control mode is enabled after the drive is switched on.

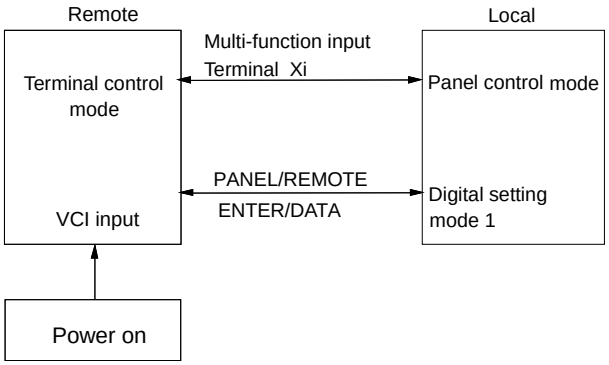


Figure 5-57 Remote and local control

Set the parameters below to realize remote and local control:

Set F0.03=1 to select terminal control mode and remote control is enabled after the drive is switched on;

Set F7.00=28, F7.01=29, to select multi-function input terminal X1 and X2 to input operating commands;

Set F7.08=1, to select 2-wire control mode 2. The drive run forward when FWD is enabled, and run reverse when REV is enabled;

Set F9.07 to 020 to enable PANEL/REMOTE;

If F9.00=041, then terminal control mode is bundled to VCI analog reference, and the panel control mode is bundled to digital reference setting 1.

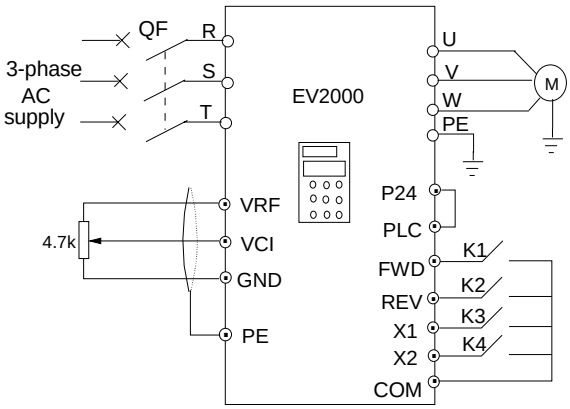


Figure 5-58 Wiring of remote and local control

Note

The parameter is default 000, that is, the frequency selector is not bundled with control mode.

F9.01 Auxiliary reference frequency selector	Range: 0~12【0】
F9.02 Auxiliary analog reference frequency coefficient	Range: 0.00~9.99【1.00】
F9.03 Initial auxiliary digital reference frequency	Range: 0.00~650.0Hz 【0.00Hz】
F9.04 Auxiliary digital reference frequency control	Range: 000~111【000】

The preset frequency of EV2000 drive is the result out of the operation on the main reference frequency and auxiliary reference frequency. F9.01~F9.04 define the auxiliary reference frequency selector. Figure 5-59 shows the process of operation.

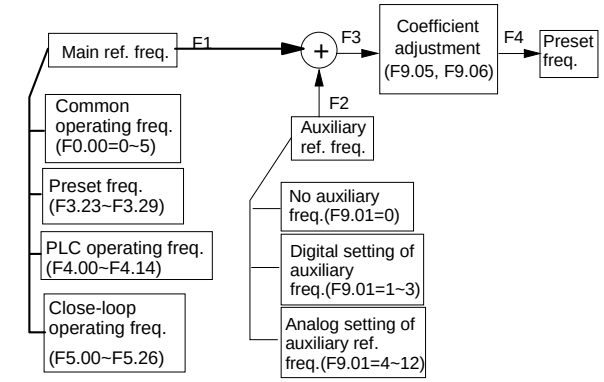


Figure 5-59 Preset frequency

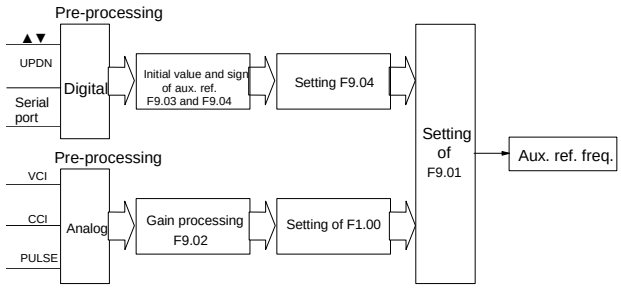


Figure 5-60 Auxiliary reference frequency selector

Auxiliary reference frequency is controlled by F9.01~F9.04. F9.01 defines the auxiliary reference frequency selector.

Table 5-14 Auxiliary reference frequency selector

SN	Reference selector	Features
0	No auxiliary reference frequency	Zero
1	Digital setting 1, set the reference by ▲ and ▼	Reference is set by F9.03, the changed frequency will be saved in F9.03 upon power outage.
2	Digital setting 2, set the reference by UP/DN	
3	Digital setting 3, set the reference serial port	
4	VCI analog input	Determined by actual input analog value, see F1.00 for frequency curves
5	CCI analog input	
6	PULSE terminal input	
7	- VCI analog input	
8	- CCI analog input	
9	- PULSE terminal input	
10	VCI-5	Determined by actual input analog value, see F1.00 for frequency curves
11	CCI-5	
12	PULSE-0.5×F1.03	

If digital setting 3 is selected, and the frequency reference is input via the serial port, then the auxiliary frequency can be changed by setting F9.03 through the host.

When selecting VCI-5 or CCI-5 to input auxiliary reference frequency, the 5V analog input should be used as a central point, from 0 to 5V, the reference frequency drops with the increase of voltage，while from 5 to 10V, the frequency increases with voltage. For example, as shown in Figure 5-61:

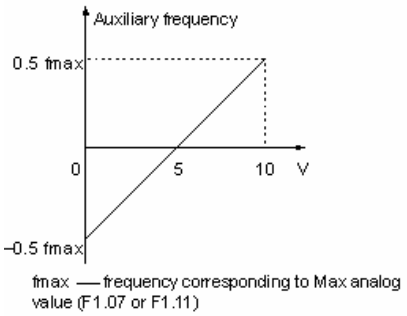


Figure 5-61 VCI-5/CCI-5 as auxiliary ref. setting method

When using PULSE-0.5×F1.03 to determine auxiliary reference frequency, one half of F1.03 (Max input pulse frequency) is the central point. Within 0~0.5×F1.03 pulse frequency, the reference frequency decreases with the increase of pulse frequency; within 0.5×F1.03~F1.03, the reference frequency increases with pulse frequency. For example, as shown in Figure 5-62:

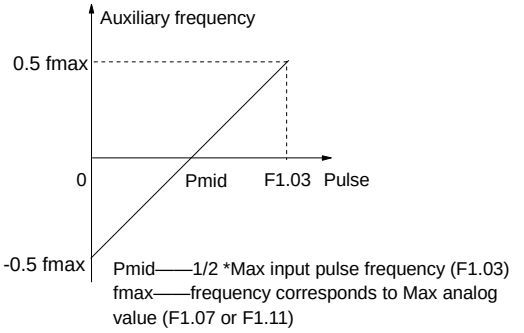


Figure 5-62 PULSE-0.5×F1.03 as auxiliary ref. setting method

F9.02: Coefficient of analog auxiliary reference

Only valid when F9.01=4~12. First, use F9.02 to calculate the gain and then calculate the auxiliary reference frequency by the frequency curve defined by F1.00.

F9.03: initial value of digital reference frequency

Only valid when F9.01=1~3. F9.03 defines the initial values of digital reference frequency when F9.01=1~3.

F9.04: digital auxiliary reference frequency control

Only valid when F9.01=1~3, as shown in Figure5-63.

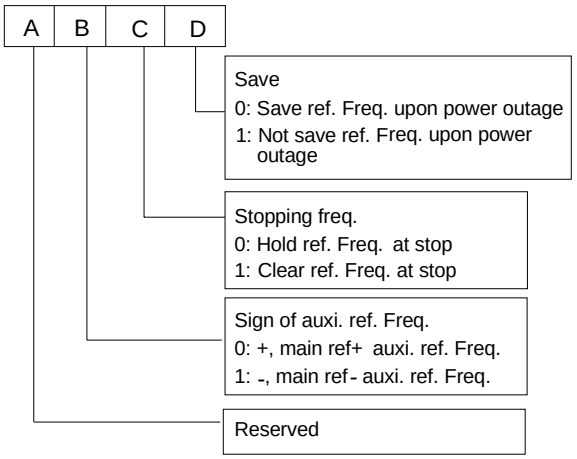


Figure 5-63 Digital auxiliary reference frequency control

Where,

A: thousand's place B: Hundred's place

C: Ten's place D: Unit's place

Unit's place: parameter-saving function at power off

0: Save the auxiliary reference frequency at power off

The auxiliary frequency will be stored in F9.03 at power off. The sign of auxiliary reference frequency is saved in F9.04.

1: not save the auxiliary frequency at power off

Ten's place: Holding of auxiliary frequency at power-off

0: Hold the auxiliary reference frequency after stop

1: Clear the preset frequency after stopping

Clear the auxiliary reference frequency after the drive stops.

Hundred's place: Sign of reference frequency

0: Plus

The sum of main reference frequency and auxiliary reference frequency is the preset frequency.

1: Minus

The result of subtracting auxiliary reference frequency from the main reference frequency is the preset frequency.

Note:

When the inputting mode of auxiliary reference frequency, such as input via panel, terminal or serial port is the same with that of main reference frequency, the auxiliary frequency is invalid.

F9.05 Frequency adjustment	Range:0~2【0】
F9.06 Adjustment coefficient of preset frequency	Range:0.0%~200.0%【100.0%】

F9.05 and F9.06 define the adjustment of preset frequency as shown in Figure 5-59.

0: Disabled

No adjustment is done to the main frequency, F4=F3

1: adjust based on max. output frequency

Preset frequency (F4)=F3+F0.05×(F9.06-100%)

2: adjust based on the main reference frequency

Preset frequency (F4)=F3+F3×(F9.06-100%) =F3×F9.06.

F9.07 Function of keys	Range: 000~422【000】

F9.07 defines the functions of PANEL/REMOTE and STOP/RESET key, and the locking up function of panel.

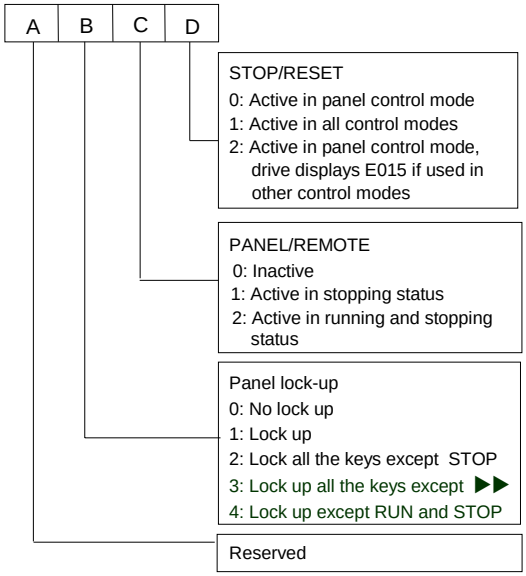

A
B
C
D
STOP/RESET
0: Active in panel control mode
1: Active in all control modes
2: Active in panel control mode, drive displays E015 if used in other control modes
PANEL/REMOTE
0: Inactive
1: Active in stopping status
2: Active in running and stopping status
Panel lock-up
0: No lock up
1: Lock up
2: Lock all the keys except STOP
3: Lock up all the keys except ▶▶
4: Lock up except RUN and STOP
Reserved

Figure 5-64 Functions of keys and panel locking up function

Where,

A: thousand's place B: Hundred's place

C: Ten's place D: Unit's place

Unit's place: Function of STOP/RESET

This Bit defines in which modes the key is valid for stopping the drive

0: Enabled only in panel control mode

1: Enabled in panel control mode, terminal and serial control modes. The drive stops in the defined manner when this key is pressed.

2: Enabled in panel control mode, terminal and serial control modes.

In panel control mode, the drive stops in defined manner when this key is pressed. But, in terminal and serial control modes, the drive will alarms and display fault code of E015 and coasts to stop.

The STOP/RESET key is valid for all control modes when resetting a fault.

Ten's place: Function of PANEL/REMOTE

0: PANEL/REMOTE is disabled.

1: PANEL/REMOTE is enabled only in stopping state, not operating state.

2: PANEL/REMOTE can be used to select the control mode both in operating status and stopping status.

Press the key to switch the control mode, and the LED will indicate the mode accordingly. When panel/control mode is selected, the LED turns on; when terminal control mode is

selected, the LED turns off; when serial port control mode is selected, the LED flashes.

Note:

After selecting a control mode by using PANEL/REMOTE, be sure to press ENTER/DATA key to confirm within 3 seconds.

Hundred's place: Locking panel

0: not lock any key on the panel.

1: Locking up function is enabled and all keys on the panel are locked up.

2: Except STOP/RESET, other keys are locked up.

3: Except ▶▶, other keys are locked up.

4: Except RUN and STOP, all other keys are locked up.

After setting the parameter, you have to do certain operation on the keypad to lock the panel. Please refer to Figure 4-8.

F9.08 Fan control mode	Range:0. 1【0】

0: Auto stopping mode

The fan runs all the time when the drive is operating. After the drive stops, its internal temperature detecting program will be activated to stop the fan or let the fan continue to run according to the IGBT's temperature.

1: The fan operates continuously.

The fan operates continuously after the drive is switched on.

F9.09 Unit of Acc/Dec time	Range: 0. 1【0】

F9.09 decides the unit of Acc/Dec time.

0: Second

1: Minute

This function is active for all the Acc or Dec process except Jogging process.

Up to 60 hours' Acc/Dec time can be set, suitable for the application with a requirement of long Acc/Dec time.

Note

It is recommended to select "second" as the unit.

F9.10 Droop control	Range:0.00~10.00Hz【0.00Hz】

When several drives drive one load, the function can make the drives share the load equally. An example is shown in Figure 5-65, 5 drives drive one conveying belt of 5 motors.

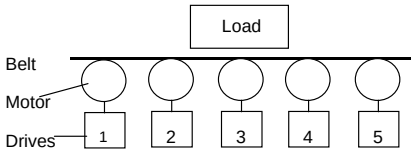


Figure 5-65 Droop control

When the load of one drive is heavier, this drive will reduce its output frequency to shed part of the load according to the settings of F9.10. You can increase the setting gradually when testing. The relationship between the load and the output frequency is shown in Figure 5-66:

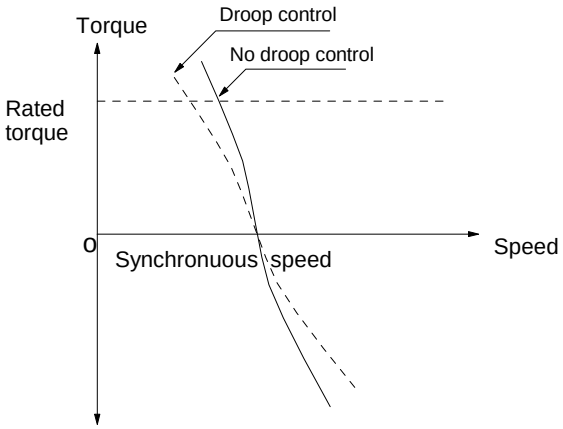


Figure 5-66 Droop control

F9.11 Overshoot enabling	Range:0. 1【1】

When the AC supply voltage is lower than 85% of rated load for a long time or the drive has driven a heavy load for a long time, the drive can increase its output voltage by increasing the utilization rate of DC bus voltage. F9.11 decides whether to enable the overshoot function.

0: disabled

1: enabled

Note

When overshoot function is enabled, output current harmonics will increase.

F9.12 Threshold of zero-frequency operation	Range: 0.00~650.00Hz【0.00Hz】
F9.13 Hysteresis of zero-frequency operation	Range: 0.00~650.00Hz【0.00Hz】

F9.12 and F9.13 are used to set the zero-frequency operation hysteresis.

Take CCI current reference for example, see Figure5-67:

Starting process

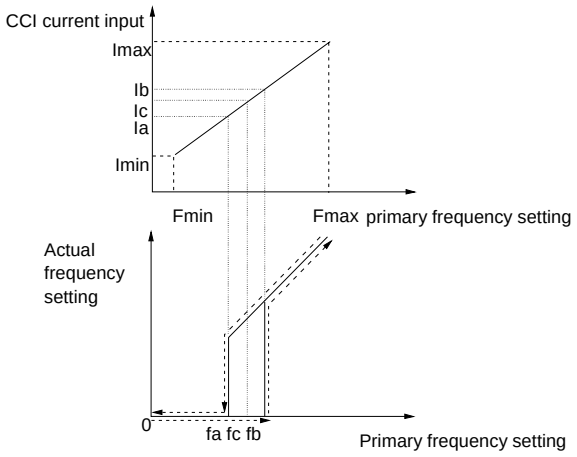
After the running command is sent out, the motor will start and accelerate to the frequency corresponding to the CCI input current until CCI input current reaches or exceeds the preset value of Ib, or the preset frequency reaches fb.

Stopping process:

The drive will not stop immediately when the CCI input current is reduced to Ib. It will stop its output when the CCI input current drops to Ia and the corresponding frequency is fa.

"fa" is the zero-frequency operation threshold defined by F9.12. "fb-fa" is the hysteresis of zero-frequency operation defined by F9.13.

This function can enable the drive to enter dormant state so as to save energy, besides, the drive will not start at the threshold of zero-frequency operation if the hysteresis is set properly.



fa: Zero frequency threshold
fb: fa+ zero freq. hysteresis
fc: Freq. corresponding to Ic(CCI input)

Figure 5-67 Hysteresis of zero-frequency operation

F9.14 Preset length	Range:0.000~65.535km 【0.000km】
F9.15 Actual length	Range:0.000~65.535km 【0.000km】
F9.16 Rate of length	Range:0.001~30.000【1.000】
F9.17 Correction coefficient of length	Range:0.001~1.000【1.000】
F9.18 Perimeter of shaft	Range:0.01~100.00cm 【10.00cm】
F9.19 Number of pulses per revolution	Range: 1~9999【1】

This group of parameters are used for fixed length control.

The drive inputs counting pulses via terminals (X7 or X8, defined as function 44), and calculate length according to the number of pulses per revolution (F9.19) and perimeter of shaft (F9.18).

Calculated length＝Number of pulses÷number of pulses per revolution×perimeter of shaft

The calculated length can be corrected through F9.16 (times of length) and F9.17(correction coefficient of length, and the corrected length is the actual length.

Actual length ＝calculated length×F9.16÷correcting coefficient of length

When actual length(F9.15) ≥ preset length(F9.14), the drive will send out a STOP command to stop the drive. When the drive restarts, it needs to clear or modify the actual length (F9.15), otherwise the drive will not start.

Note:

The actual length (terminal Xi is defined as No.39 function) can be cleared by multi-function input terminal. The actual length can be calculated only after this terminal is disconnected.

Actual length (setting of F9.15) will be saved after power off automatically.

Function of stopping at fixed length is disabled if F9.14 is set to 0, but the calculated length is still effective.

An example of stopping the motor at fixed length:

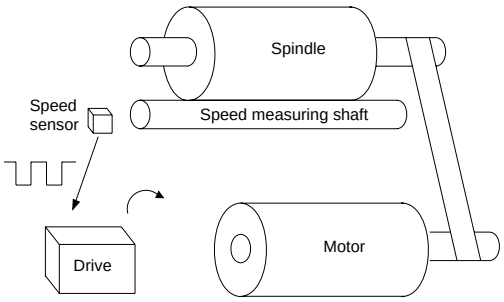


Figure 5-68 Fixed length control application

In Figure 5-68, a drive drives a motor that rotates a spindle via a conveyor belt. Speed measuring device measures the line speed of the spindle and send the speed signal to the drive in the form of pulses. The drive will count the pulses and calculate the actual length. If the actual length is longer than the preset length, the drive will stop the motor automatically. The operator can remove the spindle and close the terminal that is defined as function 39 to clear the length, and then restart and produce the next spindle.

Note:

Functions of stopping the motor at a fixed length are only valid for the drive of 45kW or below.

F9.20 Trip-free operation	Range:0. 1【0】
F9.21 Frequency decrease rate at voltage compensation	Range:0.00~99.99Hz/s 【10.00Hz/s】

Trip-free operating function enables the drive to perform low-voltage compensation when the voltage drops or instantaneous under-voltage occurs. The drive can continue to operate without tripping by reducing its output frequency and feedback energy via motor.

If F9.20 is set to 0, this function is disabled.

If F9.20 is set to 1, this function is enabled and low-voltage compensation is activated.

If F9.21 (frequency decrease rate at voltage compensation) is set too big, the feedback energy of motor will be too large and over-voltage protection might be activated; If F9.21 is set too small, the feedback energy of motor will be too small to achieve voltage compensation effect. So, please set F9.21 according to load inertia and the actual load.

Note

This function is active only for the drive of 22kW or below.

F9.22 Restart after power failure	Range:0. 1【0】
F9.23 Delay time for restart after power failure	Range:0.0~10.0s 【0.5s】

F9.22 and F9.23 decide whether the drive starts automatically and the delay time for restart when the drive is switched off and then switched on in different control modes.

If F9.22 is set to 0, the drive will not run automatically after restarted.

If F9.22 is set to 1, when the drive is powered on after power failure, it will wait certain time defined by F9.23 and then start automatically depending on the current control mode and the drive's status before power failure. See Table 5-15.

Table 5-15 Restarting conditions

Setting of F9.22	Status before power off	Control modes				
		Panel	Serial port	3-wire modes 1 and 2	2-wire modes 1 and 2	
		Without control command				With
0	Stop	0	0	0	0	0
	Run	0	0	0	0	0
1	Stop	0	0	0	0	1
	Run	1	1	1	0	1

Note

Table 5-15 shows the drive's action under different conditions. "0" means the drive enter ready status and "1" means the drive start operation automatically.

When using the panel or serial port or 3-wire modes 1 and 2 to start or stop the drive, the command signal is in pulse mode and there is no operating command when the drive is switched on.

If there is a stopping command, the drive will stop first.

When the function of restart after power failure is enabled, the drive will start on the fly after power on if it is not switched off totally (that is, the motor still runs and drive's LED displays "P.OFF"). It will start in the starting mode defined in F2.00 after power on if it is switched off totally (LED turns off).

For 2-wire mode 2, there is control command after power-on.

5.11 Reserved (Group FA)

FA.00~FA.11	Reserved

5.12 Communication Parameters (Group FF)

FF.00 Communication configuration	Range: 0000~1155H【0004】

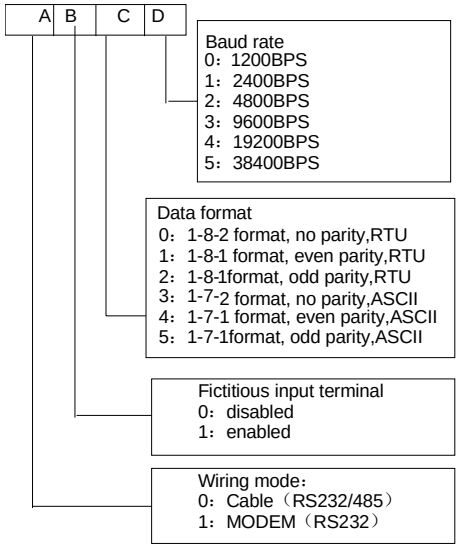


Figure 5-69 Communication parameters

Where,

A: thousand's place B: Hundred's place

C: Ten's place D: Unit's place

FF.00 is used to set the parameters of serial communication.

Virtual terminal is used by the host PC to send commands. Each Bit of the data represents one terminal. Bit0~14 represent the status of virtual terminal X1~X8, Y1, Y2, TC, FAN, BRAKE,FWD, REV respectively. The actual terminal is disabled if the virtual terminal is enabled. The virtual terminal is equivalent to the actual terminal.

The setting of thousand's Bit does not affect the communication process. If FF.00 is set to MODEM (RS232) mode, the MODEM will be initialized via the RS232 port each time when the drive is switched on, so that the MODEM can answer the call automatically after it receives 3 ringing signals. See section 3.3.2 in chapter for the wiring of remote control circuit formed by dialed circuits.

FF.01 Local address	Range:0~247【5】

In serial communication, FF.01 is used to identify the drive's address.

Note: "0" is the broadcast address. When the address is set to broadcast address, the drive can receive and execute the command sent by control PC, but will not answer it.

FF.02 Time threshold for judging communication status	Range:0~1000.0s【0.0s】

If the drive has not detected the communication signal from the serial port for certain time, it will judge that communication failure occurs. The time threshold is defined by FF.02.

If FF.02 is set to 0, the drive will not detect the communication signal of serial port and this function is disabled.

FF.03 Host PC response delay	Range:0~1000ms【5ms】

It refers to the time from drive receiving the host PC command to returning response frame to it. Under RTU mode, the response delay must not be shorter than 3.5-byte transmitting time.

5.13 Motor Parameters (Group FH)

FH.00 Number of polarities of motor	Range: 2~14【4】
FH.01 Rated power	Range:0.4~999.9kW【dependent on drive's model】
FH.02 Rated current	Range:0.1~999.9A【dependent on drive's model】

FH.00, FH.01 and FH.02 are used to set the motor's parameters.

In order to ensure the control performance, please set FH.00~FH.02 with reference to the values on the motor's nameplate.

Note

The motor's power should match that of the drive. Generally the motor's power is allowed to be lower than that of the drive by 20% or bigger by 10%, otherwise the control performance cannot be ensured.

FH.03 Current without load I_0	Range:0.1~999.9A【dependent on drive's model】
FH.04 Resistance of stator %R1	Range:0.0~50.00%【dependent on drive's model】
FH.05 Leakage inductance %Xl	Range:0.0~50.00%【dependent on drive's model】
FH.06 Resistance of rotor %R2	Range:0.0~50.00%【dependent on drive's model】
FH.07 Exciting inductance %Xm	Range:0.0~2000.0%【dependent on drive's model】

See Figure 5-70 for the above parameters.

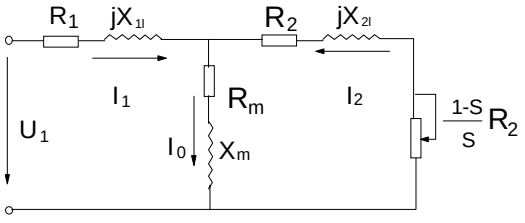


Figure 5-70 Motor's equivalent circuit

In Figure 5-70, R_1, X_{1l}, R_2, X_{2l}, X_m and I_0 represent stator's resistance, stator's leakage inductance, rotor's resistance, rotor's leakage inductance, exciting inductance and current without load respectively. The setting of FH.05 is the sum of stator's leakage inductance and rotor's inductance.

The settings of FH.04 ~FH.07 are all percentage values calculated by the formula below:

$$\%R = \frac{R}{V/\left(\sqrt{3}\cdot I\right)}\times 100\%$$

R: Stator's resistance or rotor's resistance that is converted to the rotor's side;

V: Rated voltage;

I: Motor's rated current

Formula used for calculating inducatance (leakage inductance or exciting inductance):

$$\%X = \frac{X}{V/\left(\sqrt{3}\cdot I\right)}\times 100\%$$

X: sum of rotor's leakage inductance and stator's leakage inductance (converted to stator's side)or the exciting inductance based on base frequency;

V: Rated voltage;

I: Motor's rated current

If motor's parameters are available, please set FH.04 ~FH.07 to the values calculated according to the above formula.

If the drive performs auto-tuning of motor's parameters, the results will be written to FH.03~FH.07 automatically.

After motor power (FH.01) is changed, the drive will change FH.02~FH.07 accordingly.

FH.08 Rated slip frequency	Range: 0.00~20.00Hz【0.00Hz】

Motor's rated slip frequency can be calculated by the motor's rated speed (nameplate value):

Rated slip frequency = motor's rated frequency (e.g. basic frequency F0.06)×(motor's synchronous speed-motor's rated speed)÷motor's synchronous speed

Where: motor's synchronous speed = motor's rated frequency×120÷number of motor's poles (FH.00)

After setting the slip frequency, the slip compensation will be enabled by F3.07~F3.09.

FH.09 Auto-tuning	Range:0~2【0】

The function can enable auto tuning of motor's parameters and write the results in the related parameters automatically.

0: Auto-tuning is disabled

1: Stationary auto-tuning (Start auto-tuning to a standstill motor)

Values on the motor's nameplate must be input correctly before starting auto-tuning.

When starting auto-tuning to a standstill motor, the stator's resistance (%R1), rotor's resistance (%R2) and the leakage inductance (%X1) will be detected and written into FH.04, FH.05 and FH.06 automatically.

2: Rotating auto-tuning

When starting a rotating auto-tuning, the motor is in standstill status at first, and the stator's resistance (%R1), rotor's resistance (%R2) and the leakage inductance (%X1) will be detected, and then the motor will start rotating, exciting inductance (%Xm and I_0 will be detected. All the above parameters will be saved in FH.04, FH.05, FH.06, FH.07 and FH.03 automatically.

After auto-tuning, FH.09 will be set to 0 automatically.

Auto-tuning procedures:

1. Set the "F0.06 basic operating frequency" and "F0.07 Max output voltage" correctly according to the motor's feature;

2. Set the FH.00, FH.01 and FH.02 correctly;

3. If FH.09 is set to 2, Acc time (F0.10) and Dec time (F0.11) should be set correctly.

4. Remove the load from the motor and check the safety;

5. Set FH.09 to 1 or 2, press ENTER/DATA, and then press RUN to start auto-tuning;

6. When the operating LED turns off, that means the auto-tuning is over.

Note

When setting FH.09 to 2, Acc/Dec time can be increased if over-current or over-voltage fault occurs in the auto-tuning process;

When setting FH.09 to 2, the motor's load must be removed first before starting rotating auto-tuning;

The motor must be in standstill status before starting the auto-tuning, otherwise the auto-tuning cannot be executed normally;

In some applications, for example, the motor cannot break away from the load or if you have no special requirement on motor's control performance, you can select stationary auto-tuning. You can also give up the auto-tuning. At this time, please input the values on the motor's nameplate correctly (FH.00~FH.02).

If the auto-tuning cannot be applied and the correct motor's parameters are available, the user should input the values on the motor's nameplate correctly (FH.00~FH.02), and then input the calculated values (FH.03~FH.07). Be sure to set the parameters correctly.

If auto-tuning is not successful, the drive will alarm and display fault code E024.

FH.10 Motor's stabilization factor	Range:0~255【dependent on drive's model】

FH.10 is used to suppress the oscillation caused by the drive and the motor. If the drive's output current changes frequently at constant load, you can reduce the oscillation by adjusting the parameter.

For the drive of 55kW or below, FH.10 is set at 10, and "20" for the drive of 55kW or above.

FH.11~FH.21	Reserved

Reserved

5.14 Protective Function (Group FL)

FL.00 Motor overload protection mode selection	Range:0. 1. 2【1】

0: Disabled

The overload protection is disabled. Be careful to use this function because the drive will not protect the motor when overload occurs;

1:Common mode (with low speed compensation)

Since the cooling effects of common motor deteriorates at low speed (below 30Hz), the motor's overheat protecting threshold should be lowered, which is called low speed compensation.

2: Variable frequency motor (without low speed compensation)

The cooling effects of variable frequency motor is not affected by the motor's speed, so low speed compensation is not necessary.

FL.01 Motor's overload protection coefficient	Range:20.0~110.0% 【100.0%】

In order to apply effective overload protection to different kinds of motors, the Max output current of the drive should be adjusted as shown in Figure 5-71.

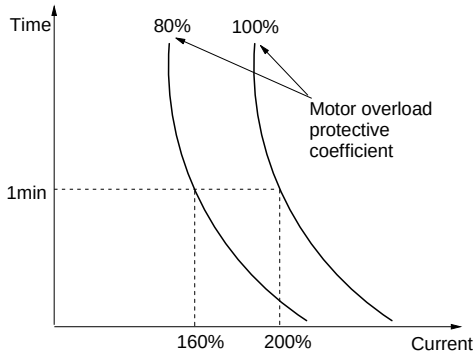


Figure 5-71 Motor's overload protection coefficient

Use the following coefficient to calculate the coefficient:

$$\text{Motor overload protection coefficient} = \frac{\text{motor rated current}}{\text{inverter's rated output current}} \times 100\%$$

Generally, the Max load current is the motor's rated current.

Note

If the motor's rated current does not match that of the drive, motor's overload protection can be realized by setting FL.00~FL.01.

FL.02 Protection of Over-voltage at stall	Range:0. 1【1】
FL.03 Over-voltage point at stall	Range:120~150%【140.0%】

0: Disabled

1: Enabled

During deceleration, the motor's decelerate rate may be lower than that of drive's output frequency due to the load inertia. At this time, the motor will feed the energy back to the drive, resulting in the voltage rise on the drive's DC bus. If no measures taken, the drive will trip due to over voltage.

During the deceleration, the drive detects the bus voltage and compares it with the over voltage point at stall defined by FL.03. If the bus voltage exceeds the stall overvoltage point, the drive will stop reducing its output frequency. When the bus voltage become lower than the point, the deceleration continues, as shown in Figure 5-72.

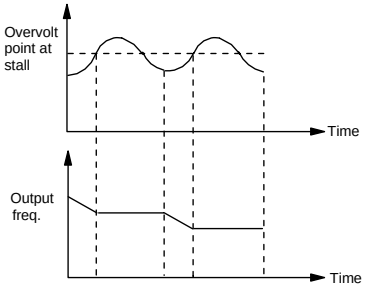


Figure 5-72 Over-voltage at stall

Note

The drive will alarm and display E015 when it is in the status of over-voltage at stall for more than 1 minute.

If the stall point is set too low, you can prolong the Acc and Dec time properly.

FL.04 Overload detection	Range:000~111【000】
FL.05 Overload pre-alarm detection threshold	Range:20~150%【130.0%】
FL.06 Overload detection time	Range:0.0~60.0s【5.0s】

EV2000 has protection over drive and motor overload. See Table 2-1 for drive overload protection, and FL.00 and FL.01 for motor overload protection. FL.04~FL.06 can monitor the overload condition before overload protection happens.

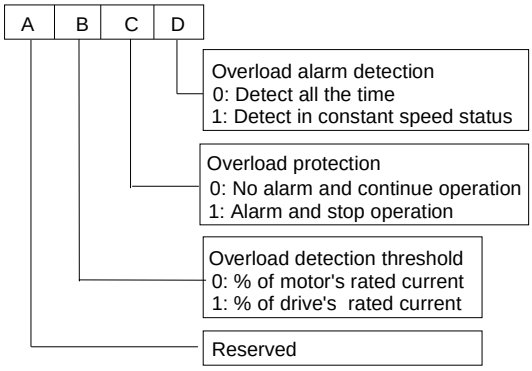


Figure 5-73 Settings of FL.04

Where,

A: thousand's place B: Hundred's place

C: Ten's place D: Unit's place

Unit's place: overload pre-alarm

0: overload pre-alarm function is active all the time when the drive is operating

1: overload pre-alarm function is active all the time when the motor is operating at constant speed

Ten's place: Actions selection for overload pre-alarm

0:The drive does not alarm and continue to run when detecting active overload signal

1: The drive alarms and stops when detecting active overload signal

Hundred's place: overload threshold selection

0: ratio of load current to motor's rated current (display fault code of E014)

1: ratio of load current to drive's rated current (display fault code E013)

FL.05 defines the current threshold for overload pre-alarm protection. The setting range is a percentage value of rated current, please refer to FL.04.

FL.06 defines the time during which the drive current exceeds FL.05. If the status remains after this period of time, the drive will output pre-alarm signal.

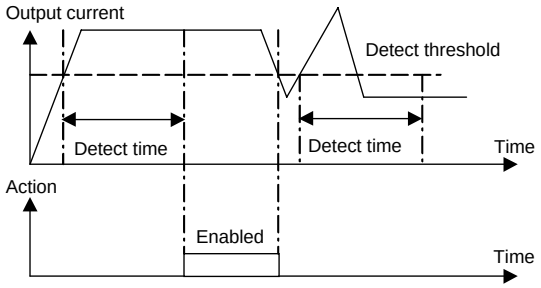


Figure 5-74 Overload pre-alarm function

Note

1. Overload pre-alarm detection threshold should be lower than the overload protection threshold;

2. During the overload detection time, if the drive's current is smaller than FL.05, the drive will time again for FL.06 and will not alarm.

FL.07 Auto current limiting threshold	Range:20.0~200.0%【depending on drive type】
FL.08 Frequency decrease rate when current limiting	Range:0.00~99.99Hz/s【10.00Hz/s】
FL.09 Auto current limiting selection	Range:0~1【1】

Auto current limiting function is used to limit the load current smaller than the value defined by FL.07 in real time. Therefore the drive will not trip due to surge over-current. This function is especially useful for the applications with big load inertia or big change of load.

FL.07 defines the threshold of auto current limiting. It is a percentage of the drive's rated current. It is default 150% for G type and 110% for P type.

FL.08 defines the decrease rate of output frequency when the drive is in auto current limiting status.

If FL.08 is set too small, overload fault may occur. If it is set too big, the frequency will change too sharply and therefore, the drive may be in generating status for long time, which may result in overvoltage protection.

Auto current limiting function is always active in Acc or Dec process. Whether the function is active in constant speed operating process is decided by FL.09.

FL.09＝0, Auto current limiting function is disabled in constant speed operating process;

FL.09＝1, Auto current limiting function is enabled in constant speed operating process;

In auto current limiting process, the drive's output frequency may change; therefore, it is recommended not to enable the function when the drive's output frequency is required stable.

When the auto current limiting function is enabled, if FL.07 is set too low, the output overload capacity will be impaired.

FL.10 Auto reset times	Range:0~10【0】
FL.11 Reset interval	Range:2.0~20.0s【5.0s】

Auto reset function can reset the fault in preset times and interval. When FL.10 is set to 0, it means “auto reset” is disabled and the protective device will be activated in case of fault.

Note

The IGBT protection (E010) and external equipment fault (E015) cannot be reset automatically.

During the reset interval, the drive stops output and operates at zero frequency. It will restart on the fly after reset.

Be careful in using auto-reset function, otherwise human injury or material loss may occur.

FL.12 Protective action 1	Range: 000~111【000】
FL.13 Protective action 2	Range: 0000~3211【0000】

Under some abnormal conditions, the drive can be set to ignore them and continue to operate without alarm or taking protective action through FL.12 and FL.13.

FL.12 defines the protective actions when communication fault, contactor fault or EEPROM fault occurs.

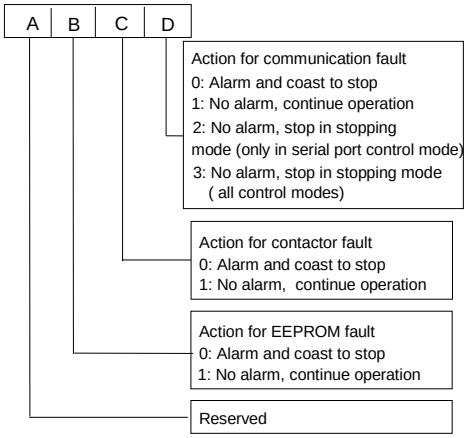

A
B
C
D
Action for communication fault
0: Alarm and coast to stop
1: No alarm, continue operation
2: No alarm, stop in stopping mode (only in serial port control mode)
3: No alarm, stop in stopping mode (all control modes)
Action for contactor fault
0: Alarm and coast to stop
1: No alarm, continue operation
Action for EEPROM fault
0: Alarm and coast to stop
1: No alarm, continue operation
Reserved

Figure 5-75 Protective action 1

Where,

A: thousand’s place B: Hundred’s place

C: Ten’s place D: Unit’s place

FL.13 defines the protective actions when the drive is in under-voltage status, auto reset interval and fault lock-up status.

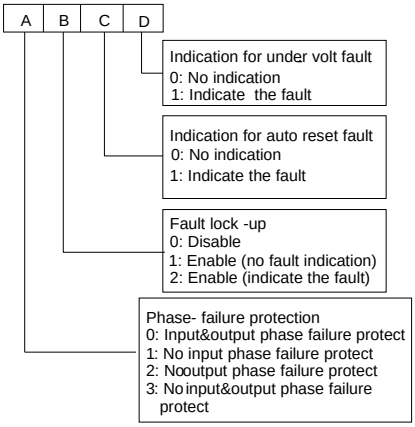


Figure 5-76 Protective action 2

Where,

A: Thousand’s place B: Hundred’s place

C: Ten’s place D: Unit’s place

Attention Please set FL.12 and FL.13 carefully, otherwise human injury or equipment damage may occur.

FL.14 Type of third latest fault	Range:0~24【0】
FL.15 Type of second latest fault	Range:0~24【0】
FL.16 Type of latest fault	Range:0~24【0】
FL.17 DC Bus Voltage at last fault	Range:0~999V【0V】
FL.18 Output current at last fault	Range:0~999.9A【0.0A】
FL.19 Frequency at last fault	Range:0.00~650.00Hz【0.00Hz】

EV2000 has 24 types of protective alarms and it can memorize the types of 3 latest faults (FL.14~FL.16), and the voltage, current and frequency (FL.17~FL.19) of latest fault.

See chapter 7 for the detailed descriptions of alarms.

5.15 Drive Parameters (Group Fn)

Fn.00 Preset operating time	Range:0~65.535k hours【0】
Fn.01 Total operating time	Range:0~65.535k hours【0】
Fn.02 Temperature of heatsink 1	Range: 0~100°C【0】
Fn.03 Temperature of heatsink 2	Range: 0~100°C【0】

When the total operating time reaches the preset operating time (Fn.00), the drive can output an indicating signal. See F7.10~F7.12 for details.

Fn.01 records the actual operating time from first use of the drive to the present.

Temperature of heatsink 1 is the temperature of IGBT modules. Different IGBT modules have different over-temperature threshold.

Temperature of heatsink 2 is the temperature of rectifier. The drive of 45kW or below does not detect this temperature.

Temperature display range: 0~100°C; accuracy: 5%

5.16 Protection of Parameters (FP)

FP.00 User’s password	Range: 0000~9999【0000】

User’s password can prevent unauthorized persons from checking and modifying the functional parameters.

Set FP.00 to 0000 if the user’s password is unnecessary.

If the user’s password is necessary, input a 4-digit none-zero figure, press ENTER/DATA to confirm. If not pressing any key within 5 minutes, the password will become effective.

Changing the password:

Press MENU/ESC, input the primary password, select FP.00 (at this time FP.00＝0000), input new password and press ENTER/DATA to confirm. The password will become effective if not pressing any key within 5 minutes.

Note

Please memorize the password.

FP.01 Parameter write-in protection	Range:0~2【1】

FP.01 is used to protect the parameter settings:

0: All parameters are allowed modifying;

1: only F0.02 and FP.01 can be modified;

2: only FP.01 can be modified.

Note

The factory setting of FP.01 is 1. If you want to modify parameters, FP.01 must be set to 0. After the modification, set the parameter back to 1 or 2.

FP.02 Parameter initialization	Range:0~2【0】

0: No operation

1: Clear memory

When FP.02 is set to 1, the fault records of FL.14~FL.19 will be cleared.

2: Restore to factory settings

If FP.02 is set to 2, the parameters before FL.12 (except F0.08 and FH.00) are restored to factory settings.

FP.02 will be changed to 0 automatically after clearing the memory or restoring to factory settings.

Note

For the drive of 45kWG or below, when FP.02 is set to 2, the motor parameters will be set matched with the drive's type G or P (defined in F0.08).

FP.03 Parameter copy	Range:0~3【0】

FP.03 is only valid for LCD panel.

0: No action

1: parameters upload

2: parameters download

3: parameters download (except the parameters related to drive type)

Note:

1. For LCD panel, you must upload parameters to the panel's memory first, otherwise, there will be no data in the memory. Once the data are uploaded, they will exist permanently.

2. Before downloading the parameters to the drive, the drive will check the version and integrity of the parameters stored in the panel. The operation cannot proceed if no data in the memory, incompleteness of the parameters, or the parameter set is incompliant with the version of the drive (e.g. number of parameters).

3. After the download, the parameters in the panel are still available for copying to other drives.

FP.04	Reserved

Chapter 6 Troubleshooting

Table 6-1 listed the possible faults of EV2000. Once a fault occurs, you may check it against the table and record detailed phenomena before seeking service from your supplier.

Table 6-1 Faults and actions

Fault code	Fault categories	Possible reasons of fault	Actions
E001	Over-current during acceleration	Too short Acc time	Prolong the Acc time
		V/F curve is not suitable.	Check and adjust V/F curve, adjust torque boost or set the motor parameters correctly to ensure the normal auto torque boost.
		The rotating motor restarts right after stop.	Set F2.00 to “start on fly” function
		Low AC supply voltage	Check the drive’s input AC supply
		Drive power is too small	Select a high power drive
E002	Over-current during deceleration	Too short Dec time	Prolong the Dec time
		The load generates energy or the load inertial is too big	Connect suitable braking kit
		Too low drive’s power	Select the drive with bigger power
E003	Over-current in constant speed operation	Sudden change of load	Reduce the change of the load
		Too short Acc/Dec time	Prolong Acc/Dec time
		Abnormal load	Check the load
		Low AC supply voltage	Check the AC supply voltage
		Insufficient drive’s power	Select the drive with bigger power
E004	Over voltage during acceleration	Abnormal AC supply voltage	Check the AC supply voltage
		Too short Acc/Dec time	Prolong the Acc time
		The rotating motor re-start after the drive stops instantly.	Set F2.00 to “start on fly” function
E005	Over voltage during deceleration	Too short Dec time (with reference to generated energy)	Prolong the Dec time
		The load generates energy or the load inertial is too big	Use suitable dynamic braking kit
E006	Over voltage in constant-speed operating process	Abnormal AC supply voltage	Check the AC supply voltage
		Too short Acc/Dec time	Prolong the Acc/Dec time
		Abnormal change of input voltage	Install input reactor
		Too big load inertia	Use suitable dynamic braking kit
E007	Drive’s control power supply over voltage	Abnormal AC supply voltage	Check the AC supply voltage or seek service
E008	Input phase loss	Any of phase R, S and T cannot be detected	Check the wiring and installation Check the AC supply voltage
E009	Output phase failure	Any of Phase U, V and W cannot be detected	Check the drive’s output wiring Check the cable and the motor
E010	Protections of IGBT act	Instantaneous over-current	Refer to E001~E003
		Short-circuit among 3-phase output or line-to-ground short circuit	Rewiring
		Vent is obstructed or fan does not work	Clean the vent or replace the fan
		Over-temperature	Lower the ambient temperature
		Wires or connectors of control board are loose	Check and rewiring
		Current waveform distorted due to output phase loss	Check the wiring
		Auxiliary power supply is damaged or IGBT driving voltage is too low	Seek service
		Short-circuit of IGBT bridge	Seek service
		Control board is abnormal	Seek service
E011	IGBT module’s heatsink overheat	Over-temperature	Lower the ambient temperature
		Vent obstructed	Clean the vent
		Fan does not work	Replace the fan
		IGBT module is abnormal	Seek service

Fault code	Fault categories	Possible reasons of fault	Actions
E012	Rectifier's heatsink overheat	Ambient over-temperature	Lower the ambient temperature
		Obstruction of ventilation channel	Clear the ventilation channel
		Fan does not work	Replace the fan
E013	Drive overload	Too short Acc/Dec time	Prolong the Acc/Dec time
		DC injection braking current is too big	Reduce the DC injection braking current or prolong the braking time
		Improper V/F curve	Adjust V/F curve or torque boost value
		The rotating motor restart after the drive stops instantly.	Set the starting mode (F2.00) to "start of fly"
		Low AC supply voltage	Check the AC supply voltage
		Too heavy load	Select the drive with bigger power
E014	Motor over-load	Improper V/F curve	Set V/F curve and torque boost value correctly
		Low AC supply voltage	Check the AC supply voltage
		Common motor has operated with heavy load at low speed for a long time.	Use a special motor if the motor is required to operate for a long time.
		Improper motor's overload protection threshold	Modify the motor's overload protection threshold.
		Load changes fast	Check the load
E015	Emergent stop or external equipment fails	STOP is pressed in non-panel control mode	Check the definition of STOP function in F9.07 and the operating mode
		STOP pressed when the drive is in stall status	Check the definition of STOP function in F9.07
		The drive will report E015 fault if it is in stall status for 1 minute	Set FL.02 and FL.03 properly
		Terminal used for stopping the drive in emergent status is closed	Disconnect the terminal if the external fault is cleared
E016	EEPROM R/W fault	R/W fault of control parameters	Press STOP/RESET to reset Seek service
E017	RS232/RS485 communication failure	Wrong baud rate setting	Set the baud rate correctly
		Serial port communication error	Press STOP/RESET to reset, seek service
		Improper settings of alarm parameters	Modify FF.02, FF.03 and FL.12
		Host PC does not work	Check the host PC; Check the wiring
E018	Contactor not closed	Low AC supply voltage	Check the AC supply voltage
		Contactor damaged	Replace the contactor in main circuit and seek service
		Soft start resistor is damaged	Replace the soft start resistor and seek service
		Control circuit is damaged	Seek service
		Input phase loss	Check the wiring of R, S, T.
E019	Current detection circuit has fault	Wires or connectors of control board are loose	Check and re-wire
		Auxiliary power supply is damaged	Seek service
		Hall sensor is damaged	Seek service
		Amplifying circuit is abnormal	Seek service
E020	System disturbance	Severe disturbance	Press STOP/RESET to reset or install power filter at the input side of the drive.
		R/W fault of DSP in main control board	Press STOP/RESET to reset Seek service
E021	Reserved	Reserved	Reserved
E022	Reserved	Reserved	Reserved
E023	Parameter copy error	Panel's parameters are not complete or the version of the parameters are not the same with that of main control board	Update the panel's parameters and version again. First set FP.03 to 1 to upload the parameters and then set FP.03 to 2 or 3 to download the parameters.
		Panel's EEPROM is damaged	Seek service
E024	Auto-tuning fails	Improper settings of parameters on the nameplate	Set the parameters correctly according to the nameplate
		Overtime of auto-tuning	Check the motor's wiring

Table 6-2 Abnormal phenomena and handling methods

Phenomena	Conditions	Possible reasons of fault	Actions
No response of operation panel	Part of the keys or all the keys are disabled	Panel is locked up	In stopping status, first press ENTER/DATA and hold on, then press ▼ 3 times continuously to unlock the panel
			Power-on the drive after it shuts down completely
		Panel's cables are not well connected.	Check the wiring
		Panel's keys are damaged	Replace operation panel or seek service
Settings of parameters cannot be changed	Operating status cannot be changed	Parameter not allowed changing during operation	Change the parameter at STOP state
	Part of parameters cannot be changed.	FP.01 is set to 1 or 2	Set FP.01 to 0
		Parameter is actually detected, not allowed changing	Do not try to modify these kind of parameters, they are marked with "*" in the parameter table in chapter 8.
	MENU/ESC is disabled	Panel is locked up	See "No response of operation panel"
	Parameter not displayed when pressing MENU/ESC. Instead, "0.0.0.0." is displayed	User's password is required	Input correct user's password
			Seek service
The drive stops during operating process	The drive stops and its "RUN" LED is off, while there is no "STOP" command	Fault alarm occurs	Find the fault reason and reset the drive
		Single cycle of PLC operation is completed	Check the parameter settings of PLC
		Function of stopping at fixed length is enabled	Clear the information of actual length or set F9.14 (setting length) to 0
		Communication between host or remote mounted keypad and the drive fails	Check the communication circuits and the settings of FF.02, FF.03 and FL.12
		AC supply is interrupted	Check the AC supply condition
		Control mode is changed	Check the setting of relevant parameters
		Logic of control terminal changes	Check the settings of F7.35
	Motor stops when there is no stopping command, while the drive's "RUN" LED illuminates and operates at zero frequency	Auto-reset upon a fault	Check the setting of auto-reset
		PLC operation stops	Check the terminal used for inputting signal of stopping PLC operation
		Stopping command is input from external terminal	Check the setting of this external terminal
		Stops at zero-frequency	Check the settings of F9.12 and F9.13
		Preset frequency is 0	Check the frequency setting
		Skip frequency is set incorrectly	Check the setting of skip frequency
The drive stops during operating process.	Motor stops without stopping command, while the drive's "RUN" LED illuminates and operates at zero frequency	Positive logic: close loop feedback value >reference Negative logic: close loop feedback value <reference	Check the close-loop reference and feedback
		F9.05 is set to 0	Check the settings of F9.05 and F9.06
		Low-voltage compensation is applied when the drive restarts after power failure, besides, the AC supply voltage is too low	Check the settings of restart after power failure and the AC supply voltage
The drive does not work	The drive does not work and its "RUN" LED is off when the "RUN" key is pressed.	Terminal used for coasting to stop is enabled	Check the terminal used for coasting to stop
		The terminal used to prohibit the running of the drive is enabled.	Check the terminal
		Terminal used for stopping the drive is enabled	Check the terminal used for stopping the drive
		The drive stops at fixed length	Check the function of stopping at fixed length and the actual length
		In 3-wire control mode, the terminal used to control the 3-wire operation is not closed.	Set and close the terminal
		Fault alarm occurs	Clear the fault
		Virtual terminal of host is set incorrectly	Disable the function of this terminal or set it properly via the host or change the settings of F7.35
		Positive and negative logic of input terminal are not set correctly	Check the settings of F7.35

Phenomena	Conditions	Possible reasons of fault	Actions
“POWEROFF” is reported when the drive begin to run immediately after power-on.	Transistor or contactor disconnected and overload	Since the transistor or contactor is disconnected, the bus voltage drops at heavier load, therefore, the drive displays POWEROFF, not E018 message.	Run the drive until the transistor or contactor is connected.

Chapter 7 Maintenance

Many factors such as ambient temperature, humidity, dust, vibration, internal component aging, wear and tear will give rise to the occurrence of potential faults. Therefore, it is necessary to conduct routine maintenance to the drives.

🕮 **Notes:**

As safety precautions, before carrying out check and maintenance of the drive, please ensure that :

The drive has been switched off;

The charging LED lamp inside the drive is off.

Use a volt-meter to test the voltage between terminals (+) and (-) and the voltage should be below 36V.

7.1 Daily Maintenance

The drive must be operated in the environment specified in the Section 2.1. Besides, some unexpected accidents may occur during operation. You should maintain the drive conditions according to the table below, record the operation data, and find out problem in the early stage.

Table 7-1 Daily checking items

Items	Instructions			Criterion
	Items	Cycle	Checking methods	
Operating environment	Temperature and humidity	Any time	Thermometer and hygrometer	-10°C ~+40°C, derating at 40°C ~50°C
	Dust and water dripping		Visual inspection	No water dripping
	Gas		Visual inspection	No strange smell
Drive	Vibration and heating	Any time	Touch the case	Stable vibration and proper temperature
	Noise		Listen	No abnormal sound
Motor	Heating	Any time	Touch by hand	No overheat
	Noise		Listen	Low and regular noise
Operating status parameters	Output current	Any time	Current meter	Within rated range
	Output voltage		Volt-meter	Within rated range
	Internal temperature		Thermometer	Temperature rise is smaller than 35°C

7.2 Periodical Maintenance

Customer should check the drive every 3 months or 6 months according to the actual environment.

🕮 **Notes:**

1. Only trained personnel can dismantle the drive to replace or repair components;

2. Don't leave metal parts like screws or pads inside the drive; otherwise the equipment may be damaged.

General Inspection:

1. Check whether the screws of control terminals are loose. If so, tighten them with a screwdriver;

2. Check whether the main circuit terminals are properly connected; whether the mains cables are over heated;

3. Check whether the power cables and control cables are damaged, check especially for any wear on the cable tube;

4. Check whether the insulating tapes around the cable lugs are stripped;

5. Clean the dust on PCBs and air ducts with a vacuum cleaner;

6. For drives that have been stored for a long time, it must be powered on every 2 years. When supplying AC power to the drive, use a voltage regulator to raise the input voltage to rated input voltage gradually. The drive should be powered for 5 hours without load.

7. Before performing insulation tests, all main circuit input/output terminals should be short-circuited with conductors. Then proceed insulation test to the ground. Insulation test of single main circuit terminal to ground is forbidden; otherwise the drive might be damaged. Please use a 500V Mega-Ohm-Meter.

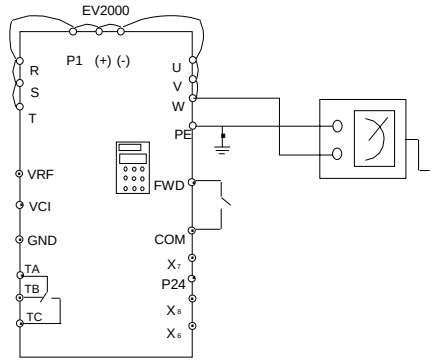


Figure 7-1 Insulation test of drive

8. Before the insulation test of the motor, disconnect the motor from the drive to avoid damaging it.

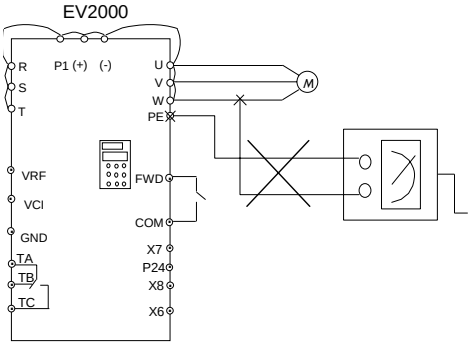


Figure 7-2 Insulation test of motor

Notes:

Dielectric strength test of the drive has already been conducted in the factory. Do not do the test again, otherwise, the internal components might be damaged.

7.3 Replacing Wearing Parts

The components that are easily damaged are: cooling fan and electrolytic capacitors of filters. Their lifetime depends largely on their application environment and preservation. Normally, lifetime is:

Components	Life
Fan	3~40,000 hours
Electrolyte capacitor	4~50,000 hours

You can decide the time when the components should be replaced according to their service time.

Cooling fan

Possible cause of damages: wear of the bearing, aging of the fan vanes.

Criteria:

After the drive is switched off, check if abnormal conditions such as crack exists on fan vanes and other parts. When the drive is switched on, check if drive running is normal, and check if there is any abnormal vibration.

2. Electrolytic capacitors

Possible cause of damages: high ambient temperature, aging of electrolyte and large pulse current induced by rapid changing loads.

Criteria: Check if frequent over-current or over-voltage failures occur during drive start-up with load. Check if there is any leakage of liquids. Check if the safety valve protrudes. Measure static capacitance and insulation resistance.

7.4 Storage

The following points must be followed for the temporary and long-term storage of drive:

1. Store in locations free of high temperature, humidity, dust, metal powder, and with good ventilation.

2. Long-term storage will cause the deterioration of electrolytic capacitors. Therefore, the drive must be switched on for a test within 2 years at least for 5 hours. The input voltage must be boosted gradually by the voltage regulator to the rated value.

7.5 Warranty

Emerson Network Power will offer warranty service in the case of the following situations:

1.The warranty clause is only confined to the drive;

2. Emerson Network Power will take the responsibility of 18 months defects liability period for any faults or damages under the normal operation conditions. After 18 months, maintenance will be charged;

3. Even within 18 months, maintenance would be charged under the following conditions:

4.Damages incurred to the drive due to incorrect operation, which are not in compliance with “User Manual”;

② Damages incurred to the drive due to fire, flood, abnormal voltage and so on;

③ Damages incurred to the drive due to the improper use of drive functions;

5. Service fee will be charged according to the actual costs. If there are any maintenance contracts, the contract prevail.

Appendix 1 Parameters

EV2000 series drive's parameters are organized in groups. Each group has several parameters that are identified by "Group No.+ Function Code. For example, "F5.08" belongs to group 5 and its function code is 8.

For the convenience of setting, parameter group number corresponds to the first level menu, parameter sub-group corresponds to the second level menu and parameter value corresponds to the third level menu.

The parameter descriptions are listed in the tables below.

Note:

1. The "modification" column in the parameter table means whether the parameter can be modified.

"O" denotes the parameters can be modified during operation or at STOP state;

"×" denotes the parameters cannot be modified during operating;

"*" denotes the parameters are actually detected and cannot be revised;

"-" denotes the parameters are defaulted by factory and cannot be modified ;

When you try to modify some parameters, the system will check their modification property automatically to avoid mis-modification.

Parameter settings are expressed in decimal (DEC) and hexadecimal (HEX). If the parameter is expressed in hexadecimal, the bits are independent to each other. The value of the bits can be 0~F.

In the tables, "LCD display" is available only for the drive with LCD keypad

"Factory settings" means the default value of the parameter. When the parameters are initialized, they will resume to the factory settings. But the actual detected or recorded parameters cannot be initialized;

The parameters can be protected against unauthorized modifications by password. After the user's password is set up (FP.00 is not set to zero), you are required to input password when you press MENU/ESC to enter menu. For the parameters exclusive for factory use, you cannot change them.

After the password is set, if no keypad operation within 5 minutes, the modification of parameters will be protected by password. You can modify the password at any time. The last input password is valid.

The user's password can be disabled by setting FP.00 to 0.

> ⚠ Attention
>
> It is defaulted that no parameters except F0.02 are allowed changing. If you need change them, please first set FP.01(parameter write-in protection) from 1

Table A-1 Parameters

Group F0: Basic Operating Parameters						
Para.	Name	LCD Display	Setting range	Unit	Factory setting	Modif.
F0.00	Reference frequency selector	FREQ SET MODE	0:Digital input 1:set the reference via ▲ and ▼ keys on panel 1:Digital input 2:set the reference via terminal UP/DN 2:Digital input 3:set the reference via serial port 3:Set the reference via VCI 4:Set the reference via CCI 5:Set the reference via PULSE terminal	1	0	○
F0.01	Digital frequency control	DIGITAL FREQ CTR	Unit's place of LED: 0:Frequency value can be saved at power off 1:Frequency value can not be saved at power off Ten's place of LED: 0:Stopping frequency holding 1:Stopping frequency recovery F0.02 Note :Only for F0.00=0,1,2	1	00	○
F0.02	Set operating frequency in digital mode	RUN FREQ SET	F0.13~F0.12 (Only for F0.00=0. 1. 2)	0.01Hz	50.00Hz	○
F0.03	Methods of inputting operating commands	RUN COMMAND SELE	0:Input via panel:(LED turns on); 1:Input via terminal:(LED off); 2:Inpuy via serial port:(LED flashes)	1	0	○

Group F0: Basic Operating Parameters						
Para.	Name	LCD Display	Setting range	Unit	Factory setting	Modif.
F0.04	Running direction setup	RUN DIRECTION	0:Run forward 1:Run reverse	1	0	○
F0.05	Maximum output frequency	MAX OUTPUT FREQ	Max{50.00,upper limit of frequency F0.12}~650.0Hz	0.01Hz	50.00Hz	×
F0.06	Basic operation frequency	BASE RUN FREQ	1.00~650.0Hz	0.01Hz	50.00Hz	×
F0.07	Max output voltage	MAX OUTPUT VOLT	1~480V	1V	Drive's rated value	×
F0.08	Type selection	MODEL SELE	0:Type G(suitable for load with constant torque) 1:Type P(suitable for load of pumps and fans) Note:Valid for the drive of 45kW or below or the type G/P integrated drive	1	0	×
F0.09	Torque boost	TORQ BOOST	0.0:(auto) 0.1%~30.0%	0.1%	0.0%	○
F0.10	Acc time 1	ACC TIME1	0.1~3600 Note: Default unit is second; Unit of Acc/Dec time is defined by F9.09	0.1	5.5kW~22kWG: 6.0s 30kW~280kWP: 20.0s	○
F0.11	Dec time 1	DEC TIME1				
F0.12	Upper limit of frequency	UPPER FREQ LIMIT	Lower limit of frequency F0.13~Maximum frequency F0.05	0.01Hz	50.00Hz	○
F0.13	Lower limit of frequency	LOWER FREQ LIMIT	0.00~upper limit of frequency F0.12	0.01Hz	0.00Hz	○
F0.14	V/F curve setting	V/F CURVE MODE	0: User-defined V/F curve(decided by F0.15~F0.20) 1: Torque-stepdown characteristic curve 1 (2.0 order) 2: Torque-stepdown characteristic curve 2 (1.7 order) 3: Torque-stepdown characteristic curve 3 (1.2 order)	1	0	×
F0.15	V/F frequency value F3	V/F FREQ3	F0.17~F0.06	0.01Hz	0.00Hz	×
F0.16	V/F voltage value V3	V/F VOLT3	F0.18~100.0%	0.1%	0.0%	×
F0.17	V/F frequency value F2	V/F FREQ2	F0.19~F0.15	0.01Hz	0.00Hz	×
F0.18	V/F voltage value V2	V/F VOLT2	F0.20~F0.16	0.1%	0.0%	×
F0.19	V/F frequency value F1	V/F FREQ1	0.00~F0.17	0.01Hz	0.00Hz	×
F0.20	V/F voltage value V1	V/F VOLT1	0~F0.18	0.1%	0.0%	×
F0.21	Cut-off point of manual torque boost	BOOST RANGE	0.0~50.0% (ratio of cut-off frequency to setting of F0.06)	0.1%	10.0%	○

Group F1: Reference frequency parameters						
Para.	Name	LCD Display	Setting range	Unit	Factory setting	Modif.
F1.00	Selection of frequency reference curve	REF CURVE SELE	Units place of LED:VCI frequency curve selection 0:Curve 1 1:Curve 2 Ten's place of LED:CCI frequency curve selection 0:Curve 1 1:Curve 2 Hundred's place of LED: Pulse frequency curve selection 0:Curve 1 1:Curve 2	1	000	○
F1.01	Gain of reference selector	REF CHAN GAIN	0.00~9.99	0.01	1.00	○
F1.02	Reference time constant of filter	FILTER CONST	0.01~50.00s	0.01s	0.50s	○
F1.03	Maximum input pulse frequency	MAX INPUT PULSE	0.1~50.0k	0.1k	10.0k	○
F1.04	Minimum reference of curve 1	MIN REF1	0.0%~F1.06 (Ratio between Min reference 1 and base value of 10V/20mA/F1.03)	0.1%	0.0%	○
F1.05	Frequency corresponding to Min. reference 1	REF1 LOW FREQ	0.00~F0.05	1	0.00Hz	○
F1.06	Max reference 1	MAX REF1	F1.04~100.0% (Ratio between Max reference 1 and base value of 10V/20mA/F1.03)	0.1%	100.0%	○

Group F1: Reference frequency parameters						
Para.	Name	LCD Display	Setting range	Unit	Factory setting	Modif.
F1.07	Frequency corresponding to Max reference 1	REF1 HIGH FREQ	0.00~F0.05	1	50.00Hz	○
F1.08	Min reference 2	MIN REF2	0.0%~F1.10 (Ratio between Min reference 2 and base value of 10V/20mA/F1.03)	0.1%	0.0%	○
F1.09	Frequency corresponding to Min reference 2	REF2 LOW FREQ	0.00~F0.05	1	0.00Hz	○
F1.10	Max reference 2	MAX REF2	F1.08~100.0% (Ratio between Max reference and base value of 10V/20mA/F1.03)	0.1%	100.0%	○
F1.11	Frequency corresponding to Max reference2	REF2 HIGH FREQ	0.00~F0.05	1	50.00Hz	○

Note

In order to be simple, all the analog value is expressed by voltage value. The formula that converts the current (mA) into voltage(V) is: Voltage(V) =Current (mA)/2.

Group F2: Starting and Braking Parameters						
Para.	Name	LCD Display	Setting range	Unit	Factory setting	Modif.
F2.00	Start mode	START MODE	0:start at start frequency 1:brake first, then start at start frequency 2:Start on the fly(including direction judgement), start at start frequency when speed is zero Note: Starting process includes switching on the drive for the first time, recover of AC supply after power failure, reset upon external fault and coast-to-stop	1	0	×
F2.01	Start frequency	START FREQ	0.20~60.00Hz	0.01Hz	0.50Hz	○
F2.02	Start frequency holding time	HOLD TIME	0.0~10.0s	0.1s	0.0s	○
F2.03	DC injection braking current at start	BRAK CURR AT START	Depending on the type of the drive P type: 0.0~80.0% of drive's rated current G type: 0.0~100.0% of drive's rated current	0.1%	0.0%	○
F2.04	DC injection braking time at start	BRAK TIME	0.0 (disabled), 0.1~30.0s	0.1s	0.0s	○
F2.05	Accelerating/decelerating mode selection	ACC/DEC MODE	0:Linear Accelerating / decelerating mode 1:S curve 2:Auto Accelerating/decelerating	1	0	×
F2.06	Start section of S curve	S CURVE START SEC	10.0%~50.0%(Acc/Dec time) F2.06+F2.07≤ 90%	0.1%	20.0%	○
F2.07	Rising time of S curve	S CURVE UP	10.0%~80.0%(Acc/Dec time) F2.06+F2.07≤ 90%	0.1%	60.0%	○
F2.08	Stopping Mode	STOP MODE	0: Dec to stop 1: Coast to stop 2: Dec to stop plus DC injection braking	1	0	×
F2.09	DC injection braking initial frequency at stop	INI BRAK FREQ	0.00~60.00Hz	0.01Hz	0.00Hz	○
F2.10	DC injection braking waiting time at stop	BRAK WAIT TIME	0.00~10.00s	0.01s	0.00s	○
F2.11	DC injection braking current at stop	BRAK CURR AT STOP	Depending on the type of the drive P type: 0.0~80.0% of drive's rated current G type: 0.0~100.0% of drive's rated current	0.1%	0.0%	○
F2.12	DC injection braking time at stop	BRAK TIME AT STOP	0.0 (disabled), 0.1~30.0s	0.1s	0.0s	○

Group F2: Starting and Braking Parameters						
Para.	Name	LCD Display	Setting range	Unit	Factory setting	Modif.
F2.13	Dynamic braking	BRAK UNIT SELE	0: Dynamic braking is not used 1: Dynamic braking is used	1	0	×
F2.14	Ratio of working time of braking kit to drive's total working time	UTILITY OF BRAK UNIT	0.0~100.0% Note: valid for the built-in braking kit of 5.5/7.5kW drive and dynamic braking should be applied in Dec process	0.1%	2.0%	×

Group F3: Auxiliary parameters						
Para.	Name	LCD Display	Setting range	Unit	Factory setting	Modif.
F3.00	Run reverse disabled	RUN REV DISABLE	0:Run reverse enabled 1:Run reverse disabled	1	0	×
F3.01	Run reverse/forward dead time	FWD/REV DEAD TIME	0~3600s	0.1s	0.0s	○
F3.02	Reserved	RESERVED	-	-	0	*
F3.03	Reserved	RESERVED	-	-	0	*
F3.04	Reserved	RESERVED	-	-	0	*
F3.05	Auto energy saving operation	ENERGY-SAVING OPR	0:disabled 1:enabled	1	0	×
F3.06	AVR function	AVR FUNC	0: disabled 1:enabled 2: disabled in decelerating process	1	2	×
F3.07	Gain of Slip compensation	SLIP COMPENSATION GAIN	0.0%~300.0%	0.1%	100.0%	○
F3.08	Slip compensation limit	SLIP COMPENSATION LIMIT	0.0%~250.0%	0.1%	200.0%	○
F3.09	Compensation time	COMPENSATION TIME CONST	0.1~25.0s	0.1s	2.0s	×
F3.10	Carrier frequency adjustment	CARRIER FREQ	Type G: 5.5kW~45kW Type P: 7.5kW~55kW: 15k~3k Type G: 55kW~90kW Type P: 75kW~110kW: 10k~1k Type G: 110kW~220kW Type P: 132kW~280kW: 6k~0.7k	0.1kHz	8.0kHz 3.0kHz 2.0kHz	○
F3.11	Carrier frequency auto-tuning	CARRIER FREQ REGULATION SELE	0:disabled 1:Enabled	1	1	○
F3.12	Motor tone adjustment	MOTOR TUNING	0~10	1	0	○
F3.13	Jog frequency	JOG OPR FREQ	0.10~50.00Hz	0.01Hz	5.00Hz	○
F3.14	Jog interval	JOG INTERVAL TIME	0.0~100.0s	0.1s	0.0s	○
F3.15	Acc time of Jog operation	JOG ACC TIME	0.1~60.0s	0.1	5.5kW~22kWG: 6.0s 30kW~280kWP: 20.0s	○
F3.16	Dec time of Jog operation	JOG DEC TIME				
F3.17	Acc time 2	ACC TIME2	0.1~3600 Note: Default unit is second; unit of Acc/Dec time is decided by F9.09	0.1		○
F3.18	Dec time 2	DEC TIME2				
F3.19	Acc time 3	ACC TIME3				
F3.20	Dec time 3	DEC TIME3				
F3.21	Acc time 4	ACC TIME4				
F3.22	Dec time 4	DEC TIME4				
F3.23	Preset frequency 1	MULTIBAND FREQ 1	F0.13 (Lower limit of frequency) ~F0.12(upper limit of frequency)	0.01Hz	5.00Hz	○
F3.24	Preset frequency 2	MULTIBAND FREQ 2			10.00Hz	
F3.25	Preset frequency 3	MULTIBAND FREQ 3			20.00Hz	
F3.26	Preset frequency 4	MULTIBAND FREQ 4			30.00Hz	
F3.27	Preset frequency 5	MULTIBAND FREQ 5			40.00Hz	
F3.28	Preset frequency 6	MULTIBAND FREQ 6			45.00Hz	
F3.29	Preset frequency 7	MULTIBAND FREQ 7			50.00Hz	

Group F3: Auxiliary parameters						
Para.	Name	LCD Display	Setting range	Unit	Factory setting	Modif.
F3.30	Skip frequency 1	SKIP FREQ1	0.00~650.0Hz	0.01Hz	0.00Hz	×
F3.31	Range of skip frequency 1	SKIP FREQ BAND1	0.00~30.00Hz	0.01Hz	0.00Hz	×
F3.32	Skip frequency 2	SKIP FREQ2	0.00~650.0Hz	0.01Hz	0.00Hz	×
F3.33	Range of skip frequency 2	SKIP FREQ BAND2	0.00~30.00Hz	0.01Hz	0.00Hz	×
F3.34	Skip frequency 3	SKIP FREQ3	0.00~650.0Hz	0.01Hz	0.00Hz	×
F3.35	Range of skip frequency 3	SKIP FREQ BAND3	0.00~30.00Hz	0.01Hz	0.00Hz	×

Group F4: Operating Parameters						
Para	Name	LCD Display	Setting range	Unit	Factory setting	Modif.
F4.00	PLC operation mode selection	PLC OPR MODE	Unit's place of LED: PLC operation mode 0:disabled 1:Stop after operating for 1 cycle 2: Holding at the final value after single cycle of operation 3:Operate continuously Ten's place of LED: Restarting mode after stopping 0:Run again from phase 1 1:Continue to run from the stopping phase 2:Operate at the time and frequency when the drive stops or fault occurs Hundred's place of LED: Save at power off 0:Not saving 1:Save the time and frequency at power off Thousand's place of LED: selecting the unit of time 0:second 1:Minute	1	0000	×
F4.01	Phase 1 setup	STAGE 1 SET	Unit's place of LED: Frequency setting 0:Pre-set frequency 1(F3.23) 1:Decided by F0.00 parameter 2:Close loop reference 1(F5.20) 3:Decided by F5.01 parameter Ten's place of LED: Running direction selection 0:Run forward 1:Run reverse 2:Decided by operating instructions Hundred's place of LED:Acc/Dec time selection 0:Acc/Dec time 1 1:Acc/Dec time 2 2:Acc/Dec time 3 3:Acc/Dec time 4	1	000	○
F4.02	Operating time in Phase 1	STAGE 1 TIME	0.0 ~ 6500	0.1	20.0	○
F4.03	Phase 2 setup	STAGE 2 SET	Unit's place of LED: Frequency setting 0:Pre-set frequency 2(F3.24) 1:Decided by F0.00 parameter 2:Close loop reference 2(F5.21) 3:Decided by F5.01 parameter Ten's place of LED: Running direction selection 0:Run forward 1:Run reverse 2:Decided by operating instructions Hundred's place of LED: Acc/Dec time selection 0:Acc/Dec time 1 1:Acc/Dec time 2 2:Acc/Dec time 3 3:Acc/Dec time 4	1	000	○
F4.04	Operating time in Phase 2	STAGE 2 TIME	0.0 ~ 6500	0.1	20.0	○
F4.05	Phase 3 setup	STAGE 3 SET	Unit's place of LED: Frequency setting 0:Pre-set frequency 3(F3.25) 1:Decided by F0.00 parameter 2:Close loop reference 3(F5.22) 3:Decided by F5.01 parameter Ten's place of LED: Running direction selection 0:Run forward 1:Run reverse 2:Decided by operating instructions Hundred's place of LED: Acc/Dec time selection 0:Acc/Dec time 1 1:Acc/Dec time 2 2:Acc/Dec time 3 3:Acc/Dec time 4	1	000	○

Group F4: Operating Parameters						
Para	Name	LCD Display	Setting range	Unit	Factory setting	Modif.
F4.06	Operating time in Phase 3	STAGE 3 TIME	0.0 ~ 6500	0.1	20.0	○
F4.07	Phase 4 setup	STAGE 4 SET	Unit's place of LED: Frequency setting 0:Pre-set frequency 4(F3.26) 1:Decided by F0.00 parameter 2:Close loop reference 4(F5.23) 3:Decided by F5.01 parameter Ten's place of LED: Running direction selection 0:Run forward 1:Run reverse 2:Decided by operating instructions Hundred's place of LED: Acc/Dec time selection 0:Acc/Dec time 1 1:Acc/Dec time 2 2:Acc/Dec time 3 3:Acc/Dec time 4	1	000	○
F4.08	Operating time in Phase 4	STAGE 4 TIME	0.0 ~ 6500	0.1	20.0	○
F4.09	Phase 5 setup	STAGE 5 SET	Unit's place of LED: Frequency setting 0:Pre-set frequency 5(F3.27) 1:Decided by F0.00 parameter 2:Close loop reference 5(F5.24) 3:Decided by F5.01 parameter Ten's place of LED: Running direction selection 0:Run forward 1:Run reverse 2:Decided by operating instructions Hundred's place of LED: Acc/Dec time selection 0:Acc/Dec time 1 1:Acc/Dec time 2 2:Acc/Dec time 3 3:Acc/Dec time 4	1	000	○
F4.10	Operating time in Phase 5	STAGE 5 TIME	0.0 ~ 6500	0.1	20.0	○
F4.11	Phase 6 setup	STAGE 6 SET	Unit's place of LED: Frequency setting 0:Pre-set frequency 6(F3.28) 1:Decided by F0.00 parameter 2:Close loop reference 6(F5.25) 3:Decided by F5.01 parameter Ten's place of LED: Running direction selection 0:Run forward 1:Run reverse 2:Decided by operating instructions Hundred's place of LED: Acc/Dec time selection 0:Acc/Dec time 1 1:Acc/Dec time 2 2:Acc/Dec time 3 3:Acc/Dec time 4	1	000	○
F4.12	Operating time in Phase 6	STAGE 6 TIME	0.0 ~ 6500	0.1	20.0	○
F4.13	Phase 7 setup	STAGE 7 SET	Unit's place of LED: Frequency setting 0:Pre-set frequency 7(F3.29) 1:Decided by F0.00 parameter 2:Close loop reference 7(F5.26) 3:Decided by F5.01 parameter Ten's place of LED: Running direction selection 0:Run forward 1:Run reverse 2:Decided by operating instructions Hundred's place of LED: Acc/Dec time selection 0:Acc/Dec time 1 1:Acc/Dec time 2 2:Acc/Dec time 3 3:Acc/Dec time 4	1	000	○
F4.14	Operating time in Phase 7	STAGE 7 TIME	0.0 ~ 6500	0.1	20.0	○

Group F5: Close-loop control parameters						
Para.	Name	LCD Display	Setting range	Unit	Factory setting	Modif.
F5.00	Close-loop function selection	CLOSELOOP FUNC SELE	0:disabled 1:enabled	1	0	×
F5.01	Reference channel selection	REF CHAN SELE	0:Digital input; (F5.02=6, F5.06, others, F5.05) 1:VCI; 2: CCI; Note: For speed-loop, analog reference of 10V corresponds to the maximum frequency defined by F0.05	1	1	○

Group F5: Close-loop control parameters						
Para.	Name	LCD Display	Setting range	Unit	Factory setting	Modif.
F5.02	Feedback channel selection	FEEDBACK CHAN SELE	0:VCI (0~10V) 1:CCI (analog input) 2:VCI+CCI 3:VCI-CCI 4:Min{VCI,CCI} 5:Max{VCI,CCI} 6:Pulse; (PG close loop signal/dual loop is decided by terminal)	1	1	○
F5.03	Filter of reference channel	REF FILTER CONST	0.01~50.00s	0.01s	0.50s	○
F5.04	Filter of feedback channel	FEEDBACK FILTER CONST	0.01~50.00s	0.01s	0.50s	○
F5.05	Set reference in digital mode	DIGITAL REF	0.00V~10.00V	0.01	0.00	○
F5.06	Speed reference set in close loop	CLOSELOOP REF	0~39000rpm	1	0	○
F5.07	PG setting	PULSE NUMBER SELE	1~9999	1	1024	○
F5.08	Min reference	MIN REF	0.0%~(F5.10) (Ratio of Min reference to base value of 10V/20mA)	0.1%	0.0	○
F5.09	Feedback value corresponding to the Min reference	MIN FEEDBACK	0.0~100.0% (Ratio of Min reference to base value of 10V/20mA)	0.1%	20.0%	○
F5.10	Max reference	MAX REF	(F5.08)~100.0% (Ratio of Max reference to base value of 10V/20mA)	0.1%	100.0%	○
F5.11	Feedback value corresponding to the Max reference	MAX FEEDBACK	0.0~100% (Ratio of Max reference to base value of 10V/20mA)	0.1%	100.0%	○
F5.12	Proportional gain KP	PROPORTION GAIN	0.000~9.999	0.001	0.050	○
F5.13	Integral gain Ki	INTEGRATION GAIN	0.000~9.999	0.001	0.050	○
F5.14	Sampling cycle	SAMPLE CYCLE	0.01~50.00s	0.01s	0.50s	○
F5.15	Limits of deviation	ERROR LIMIT	0.0~20.0%(corresponding to close loop reference)	0.1%	2.0%	○
F5.16	Close loop adjustment characteristic	CLOSELOOP FEATURE	0:Forward 1:Reverse Note: reference has no connection with speed	1	0	×
F5.17	Integral adjustment selection	INTEGRATION SELE	0:Stop the Integral adjustment when the frequency reaches the upper limit or lower limit. 1:Continue the Integral adjustment when the frequency reaches the upper limit or lower limit.	1	0	×
F5.18	Close-loop preset frequency	CLOSELOOP PRESET FREQ	0.00~650.0Hz	0.01Hz	0.00Hz	○
F5.19	Holding time of close-loop preset frequency	PRESET HOLD TIME	0.0~3600s	0.1s	0.0s	×
F5.20	Preset close-loop reference 1	CLOSELOOP REF1	0.00V~10.00V	0.01V	0.00V	○
F5.21	Preset close-loop reference 2	CLOSELOOP REF2	0.00V~10.00V	0.01V	0.00V	○
F5.22	Preset close-loop reference 3	CLOSELOOP REF3	0.00V~10.00V	0.01V	0.00V	○
F5.23	Preset close-loop reference 4	CLOSELOOP REF4	0.00V~10.00V	0.01V	0.00V	○
F5.24	Preset close-loop reference 5	CLOSELOOP REF5	0.00V~10.00V	0.01V	0.00V	○
F5.25	Preset close-loop reference 6	CLOSELOOP REF6	0.00V~10.00V	0.01V	0.00V	○
F5.26	Preset close-loop reference 7	CLOSELOOP REF7	0.00V~10.00V	0.01V	0.00V	○

Group F6: Textile Operating Function Parameters						
Para.	Name	LCD Display	Setting Range	Unit	Factory Setting	Modif.
F6.00	Textile function selection	TEXTILE FUNC SELE	0:Disabled 1:Enabled	1	0	×
F6.01	Traverse operation control mode	SWING CTR MODE	Unit's place of LED: start mode 0:Auto mode (according to F6.03) 1:Manual mode Ten's place of LED: traverse operating amplitude control 0:Variable amplitude 1:Fixed amplitude Hundred's place of LED: stopping mode of traverse operation 0:Start at the frequency and direction memorized before stopping 1:Re-start Thousand's place of LED: save parameters upon power outage 0:Saving traverse operating status at power outage 1:Not saving traverse operating status at power outage	1	0000	×
F6.02	Pre-traverse frequency	SWING BASE FREQ	0.00Hz~650.0Hz	0.01Hz	0.00Hz	○
F6.03	Waiting time before traverse	SWING WAIT TIME	0.0~3600.0s	0.1s	0.0s	○
F6.04	Traverse operating amplitude	SWING AMPLITUDE	0.0~50.0%	0.1%	0.0%	○
F6.05	Jitter frequency	JUMP FREQ	0.0~50.0% (with reference to F6.04)	0.1%	0.0%	○
F6.06	Traverse operating cycle	SWING CYCLE	0.1~999.9s	0.1s	10.0s	○
F6.07	Rising time of triangle wave	RISE TIME	0.0~100.0% (with reference to traverse operating cycle)	0.1%	50.0%	○

Note:

The central frequency is the default present frequency setting (Settings of traverse operation are not active in Jog and close-loop operation mode)

Group 7: Terminal Function Parameters						
Para.	Name	LCD Display	Setting Range	Unit	Factory setting	Modif
F7.00	Function of multi-function terminal X1	TERMINAL X1 FUNC	0:No function 1:Preseting frequency 1 2:Preseting frequency 2 3:Preseting frequency 3 4:Setting Acc/Dec time 1 5:Setting Acc/Dec time 2 6:Normally open input terminal for external fault signal 7:Normally open input terminal for external fault signal 8:Terminal for external reset signal (RESET) 9:Terminal for inputting Jog running forward command 10:Terminal for inputting Jog running reverse command 11:Coast to stop (FRS) 12:Terminal for inputting command of increasing frequency (UP) 13:Terminal for inputting command of decreasing frequency (DN) 14: Terminal for inputting command of pausing PLC operation 15: Terminal for inputting command of disabling Acc/Dec 16: Terminal for 3-wire operation control 17: Normally open contacts for input external interruption 18: Normally closed contacts for input external interruption 19:DC injection braking at stop 20:close loop inactive	1	0	×
F7.01	Function of multi-function terminal X2	TERMINAL X2 FUNC				
F7.02	Function of multi-function terminal X3	TERMINAL X3 FUNC				
F7.03	Function of multi-function terminal X4	TERMINAL X4 FUNC				
F7.04	Function of multi-function terminal X5	TERMINAL X5 FUNC				
F7.05	Function of multi-function terminal X6	TERMINAL X5 FUNC				
F7.06	Function of multi-function terminal X7	TERMINAL X7 FUNC				

Group 7: Terminal Function Parameters						
Para.	Name	LCD Display	Setting Range	Unit	Factory setting	Modif
F7.07	Function of multi-function terminal X8	TERMINAL X7 FUNC	21:PLC inactive 22:reference frequency input channel 1 23:reference frequency input channel 2 24:reference frequency input channel 3 25:Frequency reference is input via terminal CCI forcibly 26:Reserved 27:Terminal control mode is forcibly enabled 28:Command input channel 1 29:Command input channel 2 30:Multi-voltage terminal 1 31:Multi-voltage terminal 2 32:Multi-voltage terminal 3 33:Start of traverse operation 34:Clear the traverse operation status 35:external stopping command(valid for all control mode) 36:Reserved 37:Drive operation disabled 38:Reserved 39:Clear the length 40:Clear the auxiliary reference frequency 41:Clear the memorized information at the stop process of PLC operation 42:Counter clearing signal input 43:Counter trigger signal input 44:Length data input 45:Pulse frequency input 46:Single phase speed measuring input 47:speed measuring input SM1(only for X7) 48:speed measuring input SM2(only for X8)			
F7.08	FWD/REV running mode setup	OPR CTR MODE	0: 2-wire operation mode 1 1: 2-wire operation mode 2 2:3-wire control mode 1-self holding function(any terminal of terminals X1~X8) 3:3-wire control mode 2-self holding function(any terminal of terminals X1~X8)	1	0	×
F7.09	UP/DN speed	UP/DN SPEED	0.01~99.99Hz/s	0.01Hz/s	1.00Hz/s	○
F7.10	Bi-direction open collector output terminal Y1	Y1 FUNC SELE	0:Running signal(RUN) 1:frequency arriving signal(FAR) 2:frequency detection threshold (FDT1) 3:frequency detection threshold (FDT2) 4:overload signal(OL) 5:low voltage signal(LU) 6:external fault signal(EXT) 7:frequency high limit(FHL) 8:frequency low limit(FLL) 9:zero-speed running 10:Completion of simple PLC operation 11:PLC cycle completion indication 12:preset counting value arriving 13:specified counting value arriving 14:reference length arriving indication 15:drive ready (RDY) 16:drive fault 17:extended functions of host 18:Upper and lower limits of traverse operating frequency 19: preset operating time out	1	0	×
F7.11	Bi-direction open collector output terminal Y2	Y2 FUNC SELE		1	1	×
F7.12	Function selection of output relay	RELAY OUTPUT		1	16	×
F7.13	FAR duration	FAR RANGE	0.00~650.0Hz	0.01Hz	2.50Hz	○
F7.14	FDT1 level	FDT1 LEVEL	0.00~650.0Hz	0.01Hz	50.00Hz	○

Group 7: Terminal Function Parameters						
Para.	Name	LCD Display	Setting Range	Unit	Factory setting	Modif
F7.15	FDT1 lag	FDT1 LAG	0.00~650.0Hz	0.01Hz	1.00Hz	○
F7.16	FDT2 level	FDT2 LEVEL	0.00~650.0Hz	0.01Hz	25.00Hz	○
F7.17	FDT2 lag	FDT2 LAG	0.00~650.0Hz	0.01Hz	1.00Hz	○
F7.18~ F7.25	Reserved	RESERVED	-	-	0	*
F7.26	Functions of terminal AO1	ANALOG OUTPUT1	0: Output frequency before slip compensation (0~Max output frequency) 1:Output frequency after slip compensation (0~Max output frequency) 2:Preset frequency (0~Max output frequency) 3:Output current (0~2 times of drive's rated current) 4:Output current (0~2 times of motor's rated current) 5:Output torque (0~2 times of motor's rated torque) 6:Output voltage (0~1.2 times of drive's rated voltage) 7:Bus voltage (0~800V) 8:VCI (0~10V) 9:CCI (0~10V/0~20mA) 10:Output power (0~2 times of rated power) 11:Extended function of host 2(0~65535)	1	0	○
F7.27	Functions of terminal AO2	ANALOG OUTPUT2		1	3	○
F7.28	Functions of terminal DO(no output when F7.07=44~46)	DIGITAL OUPUT		1	0	○
F7.29	Analog output range	ANALOG OUTPUT OFFSET	Unit's place of LED: AO1 offset selection 0: 0~10V or 0~20Ma 1: 2~10V or 4~20mA Ten's place of LED: AO2 offset selection 0:0~10V or 0~20mA 1: 2~10V or 4~20mA	1	00	○
F7.30	AO1 output gain	A01 CALIB	0.0~200.0%	0.1%	100.0%	○
F7.31	AO2 output gain	A02 CALIB	0.0~200.0%	0.1%	100.0%	○
F7.32	Maximum output frequency of DO	MAX OUTPUT PULSE	0.1~50.0 (up to 50k)	0.1	10.0k	○
F7.33	Preset counting value reaches reference value	SET COUNT VALUE	F7.34~9999	1	0	○
F7.34	Specified counting value reaches reference value	SPECIFIED COUNT VALUE	0~F7.33	1	0	○
F7.35	Terminal's positive and negative logic	TERMINAL ENABLE STATE	Binary setting: Positive logic: Terminal Xi is enabled if it is connected to corresponding common terminal, and disabled if it is disconnected; Negative logic: Terminal Xi is disabled if it is connected to corresponding common terminal, and enabled is it is disconnected; Unit's place of LED: Bit0~Bit3:X1~X4 Ten's place of LED: Bit0~Bit3:X5~X8 Hundred's place of LED: Bit0~Bit1:FWD. REV, Bit2~Bit3:Y1. Y2	1	000	○

Group F8: Display Parameters						
Para.	Name	LCD Display	Setting Range	Unit	Factory Setting	Modif.
F8.00	Language selection (Chinese/ English)	LANGUAGE SELECT	0:Chinese 1:English Note: This function is only applicable for LCD panel	1	0	○

Group F8: Display Parameters						
Para.	Name	LCD Display	Setting Range	Unit	Factory Setting	Modif.
F8.01	Parameter group 1 displayed during operation	OPR DISPLAY1 (Not flash, ▲ and ▼ keys are valid only in frequency and speed displaying status; The status will be saved at power off)	Binary settings: 0:No display; 1:Display Unit's place of LED: Bit0: Output frequency (Hz) (before compensation) Bit1: Output frequency (Hz) (after compensation) Bit2: Reference frequency (Hz flashes) Bit3:Output current(A) Ten's place of LED: Bit0:Spinning speed(R/MIN) Bit1:Reference speed(R/MIN flashes) Bit2: Line speed(M/S) Bit3:Reference line speed(M/S flashes) Hundred's place of LED: Bit0:Output power Bit1:Output torque(%) Note: The frequency before compensation will be displayed if all the Bits are 0.	1	3FF	○
F8.02	Parameter group 1 displayed during operation	OPR DISPLAY2 (nor flash; the status will be saved at power off)	Binary settings: 0:No display; 1:Display Unit's place of LED: Bit0:Output voltage(V) Bit1:Bus voltage Bit2:VCI(V) Bit3:CCI(V) Ten's place of LED: Bit0: Analog close loop feedback(%) Bit1: Analog close loop feedback(% flashes) Bit2: External counting value(no unit) Bit3: Terminal status(no unit) Hundred's place of LED: Bit0: Actual length Bit1: reference length	1	000	○
F8.03	Parameter displayed at STOP state	STOP DISPLAY (flashes, ▲ and ▼ key are valid in frequency displaying status; the status will be saved at power off)	Binary settings: 0:No display; 1:Display Unit's place of LED: Bit0: Reference frequency(Hz) Bit1: External counting value(no unit) Bit2: Spinning speed(R/MIN) Bit3: Reference speed(R/MIN) Ten's place of LED: Bit0: Line speed(M/S) Bit1: Reference line speed(M/S) Bit2: VCI(V) Bit3: CCI(V) Hundred's place of LED: Bit0: Analog close loop feedback(%) Bit1:Analog close loop setup(%) Bit2: Actual length Bit3: Reference length Thousand's place of LED: Bit0: Terminal status(no unit) Bit1: Bus voltage Note: The reference frequency will be displayed in default if all the Bits are 0	1	1FF	○

Group F8: Display Parameters						
Para.	Name	LCD Display	Setting Range	Unit	Factory Setting	Modif.
F8.04	Coefficient of displayed speed	SPEED FACTOR	0.1~999.9% Spinning speed = actual spinning speed*F8.04(PG) Spinning speed= 120*operating Frequency/FH.00*F8.04(non PG) Reference speed = close loop reference speed*F8.04(PG) Reference speed= 120*reference frequency/FH.00*F8.04(non PG)) Note: No influence to actual speed	0.1%	100.0%	○
F8.05	Coefficient of displayed line speed	LINE SPEED FACTOR	0.1~999.9% Line speed = running frequency*F8.05(non PG)) Line speed = spinning speed*F8.05(PG) Reference line speed = reference frequency*F8.05(non PG)) Reference line speed=reference speed*F8.05(PG) Note: No influence to actual speed	0.1%	1.0%	○
F8.06	Coefficient of displayed analog close loop parameter/ feedback	CLOSELOOP DISPLAY FACTOR	0.1~999.9% Note: Analog close loop reference/feedback displaying range:0~999.9	0.1%	100.0%	○

Group F9: Enhanced Functional Parameters						
Para.	Name	LCD Display	Setting range	Unit	Factory setting	Modif.
F9.00	Control mode is bundled to frequency selector	FREQ-COMMAND ATTACHING	Unit's place of LED: Select the frequency reference selector in panel control mode 0:No bundling 1:Digital setting 1(set via ▲ and ▼) 2:Digital setting 2(set via terminal UP/DN) 3:Digital setting 3(set via serial port) 4:Set the reference via VCI 5:Set the reference via CCI 6:Set in pulse mode via terminals Ten's place of LED: Select the frequency reference selector in terminal control mode 0: No bundling 1:Digital setting 1(set via ▲ and ▼) 2:Digital setting 2(set via terminal UP/DN) 3:Digital setting 3(set via serial port) 4:Set the reference via VCI 5:Set the reference via CCI 6:Set in pulse mode via terminals Hundred's place of LED: Select the frequency reference selector in serial port control mode 0: No bundling 1:Digital setting 1(set via ▲ and ▼) 2:Digital setting 2(set via terminal UP/DN) 3:Digital setting 3(set via serial port) 4:Set the reference via VCI 5:Set the reference via CCI 6:Set in pulse mode via terminals	1	000	○

Group F9: Enhanced Functional Parameters						
Para.	Name	LCD Display	Setting range	Unit	Factory setting	Modif.
F9.01	Auxiliary reference channel	AUX REF	0:No auxiliary reference frequency; 1:Digital setting 1, set by ▲ and ▼(given by F9.03 directly); 2:Digital setting 2, set by terminal UP/DN (given by F9.03 directly); 3:Digital setting 3, set by serial port(given by F9.03 directly); 4:Set the reference via VCI 5:Set the reference via CCI 6:Set in pulse mode via terminals 4:Set the reference via VCI 5:Set the reference via CCI 9:Set in pulse mode via terminals 10:VCI-5; 11:CCI-5; 12:PULSE-0.5×F1.03 Note: Disabled together with main reference selector frequencies in items 4~12 use the setting of F1.00.	1	0	○
F9.02	Auxiliary reference coefficient	AUX REF FACTOR	0.00~9.99(only for F9.01=4~12)	0.01	1.00	○
F9.03	Initial auxiliary frequency	AUX FREQ	0.00~650.0Hz	0.01	0.00Hz	○
F9.04	Auxiliary frequency control	AUX FREQ CTR	Unit's place of LED: Saving control 0:Saving auxiliary frequency at power off 1:Not saving auxiliary frequency at power off Ten's place of LED: 0:Holding auxiliary frequency at stop 1:Clearing reference frequency at stop Hundred's place of LED: polarities of frequency 0:Positive 1:Negative Note: Only valued at F9.01=1, 2 or 3	1	000	○
F9.05	Frequency adjustment	FREQ ADJ	0:Disabled 1:Percentage of F005 2:Percentage of present frequency	1	0	○
F9.06	Adjustment coefficient of reference frequency	ADJ FACTOR	0.0%~200.0%	0.1%	100.0%	○
F9.07	Function of keys	KEY FUNC SELE	Unit's place of LED:STOP/RESET key's function selection 0:Valid in panel control mode 1:Stop in stopping mode in panel, terminal and serial port control mode 2:Coast to stop in non-panel control mode, stop in stopping mode in panel control mode Ten's place of LED: function of PANEL/REMOTE key 0:Inactive 1:Stopping status active 2:Valid in stopping and running modes Hundred's place of LED: Keypad locking function 0:No locking 1:Locked 2:All the keys except the STOP/RESET key are locked 3:All the keys except the SHIFT key are locked 4:All the keys except the RUN and STOP/RESET keys are locked	1	000	×
F9.08	Cooling fan control	FAN CTR	0:Auto operation mode 1:Fan operate continuously when power is on Note: Continue to operate for 3 minutes	1	0	×
F9.09	Unit of Accelerating/decelerating time	ACC/DEC UNIT	0: Second 1: Minute	0	0	×

Group F9: Enhanced Functional Parameters						
Para.	Name	LCD Display	Setting range	Unit	Factory setting	Modif.
F9.10	Drop control	DROOP CTR	0.00~10.00Hz	0.01Hz	0.00Hz	○
F9.11	Overshoot enabled	OVER MODULATION ENABLE	0:Disabled 1:Enabled	1	1	×
F9.12	Zero-frequency operation threshold	ZERO FREQ THRESHOLD	0.00~650.00Hz	0.01Hz	0.00Hz	○
F9.13	Zero-frequency hysteresis	ZERO FREQ HYSTERESIS	0.00~650.00Hz	0.01Hz	0.00Hz	○
F9.14	Reference length (Stop at fixed length)	LENGTH SET	0.000(function of stopping at fixed length is disabled)~65.535km	0.001km	0.000km	○
F9.15	Actual length (Saving at power off)	LENGTH	0.000~65.535km(saving at power off)	0.001km	0.000km	○
F9.16	Ratio of length	LENGTH SCALE	0.001~30.000	0.001	1.000	○
F9.17	Length correction coefficient	LENGTH CALIBRATION	0.001~1.000	0.001	1.000	○
F9.18	Perimeter of axis	SHAFT GIRTH	0.01~100.00cm	0.01cm	10.00cm	○
F9.19	Number of pulses per cycle	PULSES PER CYCLE	1~9999	1	1	○
F9.20	Trip-free operating function	NO STOP DURING P.OFF	0: Disabled 1: Enabled (low voltage compensation) (Valid for the drive below 15kW)	1	0	×
F9.21	Frequency decrease rate at voltage compensation	FREQ SLOW RATE 1	0.00~99.99Hz/s	0.01Hz/S	10.00Hz/s	○
F9.22	Function of restart after power failure	RESTART AFTER POFF	0:Disabled 1:Enabled	1	0	×
F9.23	Delay time for restart after power failure	DELAY TIME BEFORE RESTART	0.0~10.0s	0.1s	0.5s	○

Note:

1. Actual length(km)=﹛counting value* Perimeter of axis(F9.18)/ Number of pulses per cycle(F9.19)﹜* Ratio of length(F9.16)/calibration coefficient of length(F9.17)/100/1000.

2. Functions of F9.14~F9.19 are only valid for the drive of 45kW or below.

Group FA: Reserved Parameters						
Parameter	Name	LCD Display	Setting range	Unit	Factory setting	Modification
FA.00~FA.11	Reserved	RESERVED	-	-	0	*

Group FF: Communication Parameters						
Para.	Name	LCD Display	Setting range	Unit	Factory setting	Modif.
FF.00	Communication configuration	COMM CONFIG	Unit's place of LED: Baud rate selection 0：1200BPS 1：2400BPS 2：4800BPS 3：9600BPS 4：19200BPS 5：38400BPS Ten's place of LED: Data format 0：1-8-2 format, no parity check, RTU 1：1-8-1 format, even check, RTU 2：1-8-1 format, odd check, RTU 3：1-7-2 no parity check, ASCII 4：1-7-1 format, even check, ASCII 5：1-7-1 format, odd check, ASCII Hundred's place of LED: virtual input terminal 0:Disabled 1: Enabled Thousand's place of LED: wiring mode 0:Direct connection via cable (RS232/485) 1: MODEM (RS232)	1	004	×
FF.01	Local address	LOCAL ADDR	0~247, 0 is the broadcasting address	1	5	×

Group FF: Communication Parameters						
Para.	Name	LCD Display	Setting range	Unit	Factory setting	Modif.
FF.02	Time threshold for judging the communication status	TIMEOUT SETTING	0.0~1000s	0.1	0.0s	×
FF.03	Delay for responding to control PC	SCI REPLY DELAY	0~1000ms	1	5ms	×

Group FH: Motor Parameters						
Para.	Name	LCD Display	Setting range	Unit	Factory setting	Modif.
FH.00	Number of polarities of motor	MOTOR POLARITY NUM	2~14	2	4	×
FH.01	Rated power	RATED POWER	0.4~999.9kW	0.1kW	Dependent on drive's model	×
FH.02	Rated current	RATED CURR	0.1~999.9A	0.1A	Dependent on drive's model	×
FH.03	Current without load	CURR WITH NO LOAD	0.1~999.9A	0.1A	Dependent on drive's model	×
FH.04	Resistance of stator R1	STATOR RESIS R1	0.00%~50.00%	0.01%	Dependent on drive's model	○
FH.05	Leakage inductance X	LEAKAGE INDUC X	0.00%~50.00%	0.01%	Dependent on drive's model	○
FH.06	Resistance of rotor R2	ROTOR RESIS R1	0.00%~50.00%	0.01%	Dependent on drive's model	○
FH.07	Exciting inductance Xm	MUTUAL INDUC Xm	0.0%~2000%	0.1%	Dependent on drive's model	○
FH.08	Rated slip	RATED SLIP	0.00~20.00Hz	0.01Hz	0.00Hz	○
FH.09	Parameter self-adjustment	PARA AUTOSET	0:Disabled 1:Enabled (motor in standstill state) 2:Enabled (motor is running)	1	0	×
FH.10	Motor stabilization factor	MOTOR STEAD FACTOR	0~255	1	Dependent on drive's model	○
FH.11 ~ FH.21	Reserved	RESERVED	-	-	0	*

Group FL: Protection Parameters						
Para.	Name	LCD display	Setting range	Unit	Factory setting	Modif.
FL.00	Motor overload protection mode selection	OVERLOAD PROTECTION	0:Disabled 1:Common motor (with low speed compensation) 2:Variable frequency motor (without low speed compensation)	1	1	×
FL.01	Motor overload protection coefficient setup	THERMAL RELAY	20.0~110.0%	0.1%	100.0%	×
FL.02	Over voltage at stall	OVERVOLT STALL	0:Disabled (when braking resistor is mounted) 1:Enabled	1	1	×
FL.03	Over voltage point at stall	STALL OVERVOLT REF	120.0~150.0%Udce	0.1%	140.0%	×
FL.04	Overload detection setup	OVERLOAD DETECT	Unit's place of LED: 0:Detect all the time 1:dDtect only at constant speed running Ten's place of LED: alarm selection 0: Drive will not alarm, and continue to operate 1: Drive alarms and stops Hundred's place of LED: selection of detected value 0: % of rated current of motor(E014) 1: % of rated current of drive(E013)	1	000	×
FL.05	Overload detection	OVERLOAD LIMIT	20.0%~200.0%	0.1%	130.0%	×
FL.06	Overload detection time	OVERLOAD DETECT TIME	0.0~60.0s	0.1s	5.0s	×

Group FL: Protection Parameters						
Para.	Name	LCD display	Setting range	Unit	Factory setting	Modif.
FL.07	Auto current limiting level	CURR LIMIT	20.0%~200.0%Ie	0.1%	G type: 150.0% P type: 110%	×
FL.08	Frequency decrease rate in current limiting	FREQ SLOW RATE 2	0.00~99.99Hz/s	0.01 Hz/s	10.00 Hz/s	○
FL.09	Auto current limiting action selection	AUTO CURR LIMIT	0:Invalid at constant speed 1:Valid at constant speed Note: Acceleration and deceleration are valid	1	1	×
FL.10	Auto reset times	AUTO RESET TIMES	0~10, “0” means no auto reset function Note: No auto reset function for module protection and external equipment fault.	1	0	×
FL.11	Reset interval	RESET INTERVAL	2.0~20.0s/time	0.1s	5.0s	×
FL.12	Protective action 1	PROTECTION ACTION 1	Unit’s place of LED: Protective action triggered by communication failure 0:Alarm and coast to stop 1:No alarm and continue running 2:No alarm and stop in stopping mode(only in serial port control mode) 3: No alarm and stop in stopping mode(in all control modes) Ten’s place of LED: Protective action triggered by contactor failure 0:Alarm and coast to stop 1:No alarm and continue running Hundred’s place of LED: Protective action triggered by EEPROM fault 0:Alarm and coast to stop 1:No alarm and continue	1	001	×
FL.13	Protective action 2	PROTECTION ACTION 2	Unit’s place of LED: Protective action triggered by under voltage 0:Disabled 1:Enabled (under voltage is considered as a fault) Ten’s place of LED: Fault indication during auto-reset interval enabled 0:Disabled 1:Enabled Hundred’s place of LED:fault locking function selection 0:Disabled 1:Enabled (fault indication is disabled) 2:Enabled (fault indication is enabled) Thousand’s place of LED: Phase failure function enabled 0:Input and output phase failure protective function enabled 1:Input phase failure protective function disabled 2:Output phase failure protective function disabled 3:Input and output phase failure protective function disabled	1	0000	×
FL.14	Type of third latest fault	1st fault	0:No fault 1:Over-current in accelerating process(E001) 2:Over-current in decelerating process (E002) 3:Over-current in constant-speed running process (E003)	1	0	*
FL.15	Type of second latest fault	2nd fault				

Group FL: Protection Parameters						
Para.	Name	LCD display	Setting range	Unit	Factory setting	Modif.
FL.16	Type of latest fault	3rd FAULT	4:Over-voltage in accelerating process (E004) 5:Over-voltage in decelerating process (E005) 6:Over-voltage in constant-speed running process (E006) 7:Control power supply over voltage(E007) 8:Input phase failure(E008) 9:Output phase failure(E009) 10:IGBT protection(E010) 11:IGBT Heatsink over-temperature (E011) 12:Rectifier Heatsink over-temperature (E012) 13:Drive overload (E013) 14:Motor overload (E014) 15:Emergent stop (E015) 16:EEPROM w/r error (E016) 17:serial port communication fault(E017) 18:contactor fault(E018) 19:current detection circuit fault (E019) (hall sensor or amplify circuit fault) 20:system disturbance (E020) 21:Reserved 22:Reserved 23:Paremeter copy fault (E023) 24:self-adjustment fault (E024) Note: ① E007 can be detected by 18.5G/22G drive after it is in stop state for 3 minutes. It cannot be detected by the drive below 15G. It can be detected by the drive of other models all the time ② E010 can be reset after 10 seconds;			
FL.17	DC Bus Voltage at the last fault	VOLT AT FAULT	0~999V	1V	0V	*
FL.18	Current at the last fault	CURR AT FAULT	0.0~999.9A	0.1A	0.0A	*
FL.19	Frequency at the last fault	FREQ AT FAULT	0.00Hz~650.0Hz	0.01 Hz	0.00Hz	*

Group Fn: Drive's Parameters						
Parameter	Name	LCD Display	Setting range	Unit	Factory setting	Modification
Fn.00	Preset operating time	ENGAGE RUN TIME	0~65.535K hours	0.001k hours	0	○
Fn.01	Total operating time	TOTAL RUN TIME	0~65.535K hours	0.001k hours	0	*
Fn.02	Temperature of heatsink 1	HEATSINK1 TEMP	0.0~100.0°C	0.1	0°C	*
Fn.03	Temperature of heatsink 2	HEATSINK2 TEMP	0.0~100.0°C	0.1	0°C	*

Group FP: Parameter Security Functions						
Parameter	Name	LCD Display	Setting range	Unit	Factory setting	Modification
FP.00	User's password	USER PASSWORD	0:No password Others: Protected by Password	0	0	○
FP.01	Selection of parameter write-in states	PARA PROTECTION	0: Modifying all parameters is enabled 1: Modifying other parameters is disabled except F0.00 and EP.01 2: Modifying other parameters is disabled except EP.01	1	1	○
FP.02	Parameter initialization	PARA INITIALIZE	0: Parameter modification enabled state 1: clear the memorizing information (FL.14~19) 2: Recover the factory settings (before FL.13)	1	0	×

Group FP: Parameter Security Functions						
Parameter	Name	LCD Display	Setting range	Unit	Factory setting	Modification
FP.03	Parameter copy	PARA COPY	0:disabled 1:parameter upload 2:parameter download 3:parameter download (except the parameters related to the drive itself) Note: Only valid to LCD panel;	1	00	×
FP.04	Reserved	RESERVED	-	-	0	*

Group FU: Factory Settings						
Parameter	Name	LCD Display	Setting range	Unit	Factory setting	Modification
FU.00	Factory password	FACTORY PASSWORD	****	1	Factory password	-

Appendix 2 Accessories

Notes:

Our company does not supply reactor and EMI filter, so you should order them separately. The following models have been tested on our drive. You can contact us if you need them.

1. Input and output reactor

Models

AC input reactor: TDL-4AI01-0300, where 0300 denotes the power level, similar to the power level of the drive.

AC output reactor: TDL-4AO01-0300, where 0300 denotes the power level, similar to the power level of the drive.

DC reactor: TDL-4DI01-0300, where 0300 denotes the power level, similar to the power level of the drive.

Sizes

■AC input reactor(TDL-4AI01-□□□□)

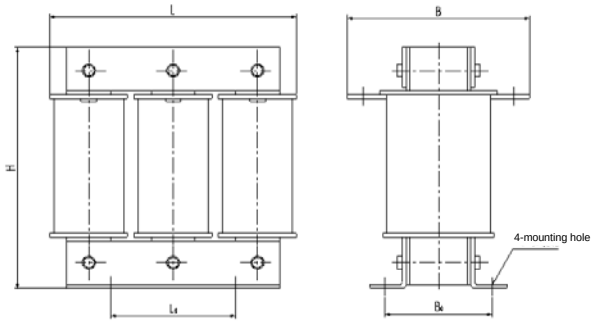


Figure A-1 Sizes of AC input reactor

Table A-2 Mechanical parameters of 380V AC input reactor

Drive's power [kW]		Reactor's model	Figure No.	Sizes[mm]							Weight [kg]
				L	B	H	L_0	B_0	Terminal diameter	Diameter of mounting hole	
5.5	7.5	TDL-4AI01-0075	Figure A-1	170	80	170	80	65	M6	Φ8	6.0
11	15	TDL-4AI01-0150	Figure A-1	180	140	180	80	65	M6	Φ8	9.0
18.5	22	TDL-4AI01-0220	Figure A-1	200	150	200	90	70	M8	Φ8	11
30	37	TDL-4AI01-0370	Figure A-1	200	150	215	110	85	M8	Φ10	15
45	55	TDL-4AI01-0550	Figure A-1	230	180	210	110	85	M10	Φ10	20
75	90	TDL-4AI01-0900	Figure A-1	260	150	270	180	85	M10	Φ10	30
110	132	TDL-4AI01-1320	Figure A-1	330	170	350	200	85	Φ12	Φ12	38
160		TDL-4AI01-1600	Figure A-1	340	180	350	200	90	Φ12	Φ12	45
200	220	TDL-4AI01-2200	Figure A-1	370	170	350	200	90	Φ12	Φ12	50

■AC output reactor (TDL-4AO01-□□□□)

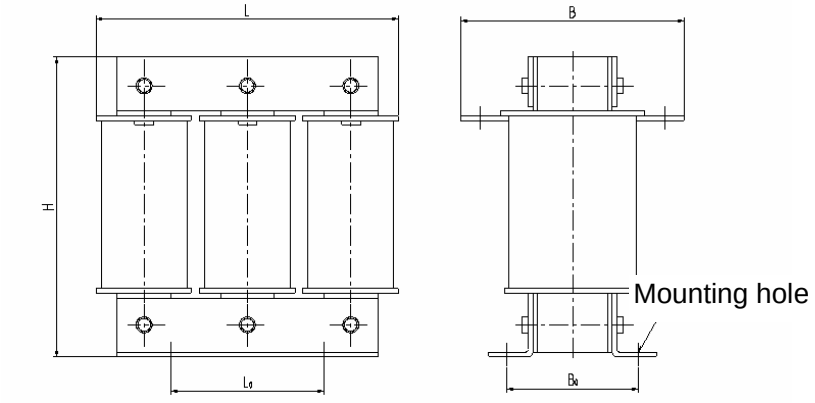


Figure A-2 Sizes of AC output reactor

Table A-3 Mechanical parameters of 380V AC output reactor

Drive's power[kW]		Reactor's model	Figure No.	Sizes[mm]							Weight [kg]
				L	B	H	L_0	B_0	Terminal diameter	Diameter of mounting hole	
5.5	7.5	TDL-4AO01-0075	Figure A-2	210	120	170	140	70	M6	Φ8	10
11	15	TDL-4AO01-0150	Figure A-2	230	140	210	150	80	M6	Φ8	17
18.5	22	TDL-4AO01-0220	Figure A-2	230	140	230	150	90	M8	Φ8	22

Drive's power[kW]		Reactor's model	Figure No.	Sizes[mm]							Weight [kg]
				L	B	H	L_0	B_0	Terminal diameter	Diameter of mounting hole	
30	37	TDL-4AO01-0370	Figure A-2	240	150	295	160	90	M8	Φ10	36
45	55	TDL-4AO01-0550	Figure A-2	255	160	295	160	100	M10	Φ10	40
75	90	TDL-4AO01-0900	Figure A-2	285	160	360	190	110	M10	Φ10	58
110	132	TDL-4AO01-1320	Figure A-2	380	170	400	250	110	Φ12	Φ12	75
160		TDL-4AO01-1600	Figure A-2	420	180	410	270	110	Φ12	Φ12	83
200	220	TDL-4AO01-2200	Figure A-2	450	200	450	300	120	Φ12	Φ12	116

■DC reactor (TDL-4DI01-□□□□)

75kWG drive and the drive with standard configurations have DC reactor. Only the model and parameters of reactor used for 55kW drive or below are listed below.

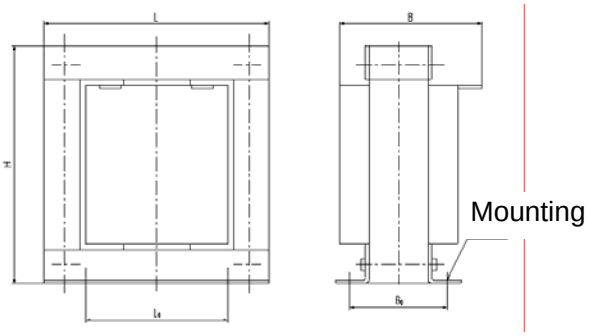


Figure A-3 Sizes of DC reactor

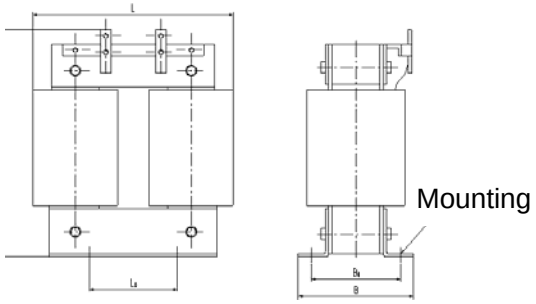


Figure A-4 Sizes of DC reactor

Table A-4 Mechanical parameters of 380V DC reactor

Drive's power [kW]		Reactor's model	Figure No.	Sizes[mm]							Weigh t [kg]
				L	B	H	L_0	B_0	Terminal diameter	Diameter of mounting hole	
11	15	TDL-4DI01-0150	Figure A-3	130	110	120	80	80	M8	Φ6	6.0
18.5	22	TDL-4DI01-0220	Figure A-3	140	115	140	80	90	M8	Φ6	8.0
30	37	TDL-4DI01-0370	Figure A-4	160	110	210	60	80	M8	Φ10	10
45	55	TDL-4DI01-0550	Figure A-4	170	110	210	60	90	M10	Φ10	15

2. 380V series EMI filter

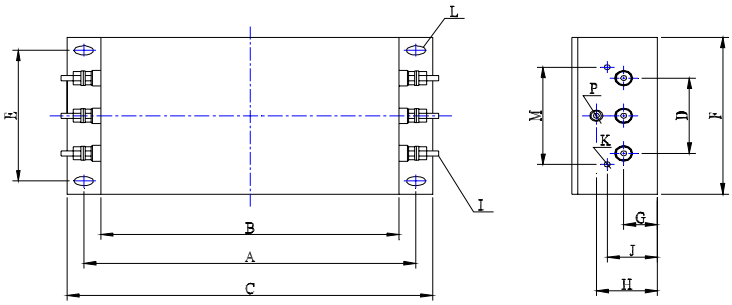


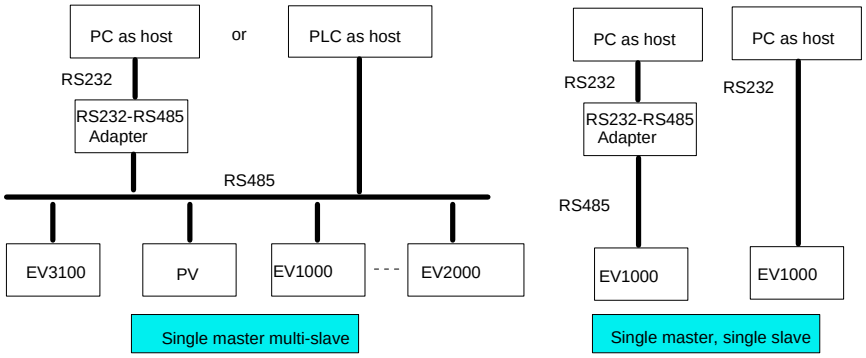
Figure A-5 Outline of EMI

Table A-5 Mechanical parameters of EMI filter

Drive's power [kW]		Filter's model	Sizes[mm]															Weight [kg]
			A	B	C	D	E	F	G	H	I	J	K	M	N	P	L	
5.5	7.5	DL-20EBT1	243	220	261	58	70	100	25	90	M6	58	M4	74	49	M6	6.4×9.4	3.5
11	15	DL-35EBT1	243	220	261	58	70	100	25	90	M6	58	M4	74	49	M6	6.4×9.4	4.0
18.5	22	DL-50EBT1	243	220	261	58	70	100	25	90	M6	58	M4	74	49	M6	6.4×9.4	4.0
30	37	DL-80EBT1	354	320	384	66	155	185	30	90	M8	62	M4	86	56	M8	6.4×9.4	8.5
45		DL-100EBK1	354	320	384	66	155	185	30	90	M8	62	M4	86	56	M8	6.4×9.4	9.0
55	75	DL-150EBK1	354	320	384	66	155	185	30	90	M8	62	M4	86	56	M8	6.4×9.4	9.5
90		DL-200EBK1	354	320	384	66	190	220	35	100	M8	62	M4	86	61	M8	6.4×9.4	13.0

Appendix 3 Communication Protocol

1 Network Topology



2 Communication Mode

RS485: asynchronous, half-duplex

Default: 8-N-2, 19200bps. See Group FF parameter settings.

1) The protocol is Modbus protocol. Besides the common register Read/Write operation, it is supplemented with commands of parameters management.

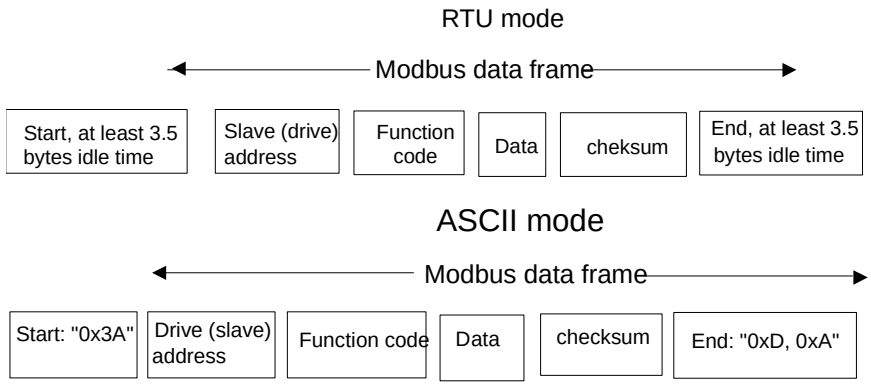
2) The drive is a slave in the network. It communicates in 'point to point' master-slave mode. It will not respond to the command sent by the master via broadcast address.

3) In the case of multi-drive communication or long-distance transmission, connecting a 100~120Ω resistor in parallel with the master signal line will help to enhance the immunity to interference.

4) EV2000 provides two interfaces: RS232 and RS485. Pay attention that the Jumper CN14 should be put at correct position.

3 Protocol Format

Modbus protocol support both RTU and ASCII mode. The frame format is illustrated as follows:



Modbus adopts "Big Endian" representation for data frame. This means that when a numerical quantity larger than a byte is transmitted, the most significant byte is sent first.

Under RTU mode, the idle time between frames is decided by the bigger value between parameter setting by FF.03 and the Modbus minimum idle time. The minimum Modbus idle time between frames should be no less than 3.5 bytes. The checksum adopts CRC-16 method. All data except chekcsum itself sent will be counted into the calculation. Please refer to section: CRC Check for more information. Note that at least 3.5 bytes of modbus idle time should be kept, and the start and end idle time need not be summed up to it.

The table below shows the data frame of reading parameter 002 from Drive No. 1.

Address	function code	Register Address		Quantity of inputs		Checksum	
0x01	0x03	0x00	0x02	0x00	0x01	0x25	0xCA

The table below shows the reply frame from Drive No. 1.

Address	Parameter	Reply bytes	Register content		Checksum	
0x01	0x03	0x02	0x13	0x88	0xB5	0x12

In ASCII mode, the frame head is “0x3A”, and default frame tail is “0x0D” or “0x0A”. The frame tail can also be configured by users. Except frame head and tail, other bytes will be sent as two ASCII characters, first sending higher nibble and then lower nibble. The data have 7 bits. “A”~“F” corresponds to the ASCII code of respective capital letter. LRC check is used. LRC checksum is calculated by adding all the successive 8-bit bytes of the message except the head and tail, discarding any carriers, and then complementing the result.

Example of Modbus data frame in ASCII mode:

The command frame of writing “4000 (0xFA0)” into Register 002 of Drive No. 1 is shown in the table below:

LRC checksum=the complement of (01+06+00+02+0x0F+0xA0)= 0x48

	Frame head	Address		Function code		Register Address				Content				Check sum		Frame tail	
Code	:	0	1	0	6	0	0	0	2	0	F	A	0	4	8	CR	LF
ASCII	3A	30	31	30	36	30	30	30	32	30	46	41	30	34	38	0D	0A

Different respond delay time can be set through drive’s parameters to adapt to different needs. For RTU mode, the respond delay time should be no less than 3.5 bytes interval, and for ASCII mode, no less than 1ms.

4 Protocol Function

The main functions of Modbus are to read and write parameters. The Modbus protocol supports the following function code:

Function code	Function
0x03	Read drive’s parameter and operation status parameters
0x06	Modify single drive’s parameter or control parameters. Not save them upon power-off.
0x08	Serial line diagnosis
0x10	Modify several drives’ parameter or control parameters. Not save them upon power-off.
0x41	Modify single drive’s parameter or control parameters. Saving them upon power-off.
0x42	Parameter management

All drive’s parameters, control and status parameters are mapped to Modbus R/W Register. The R/W properties of the parameters and their setting ranges are specified in the user manual. The group number of the drive’s parameter maps to the most significant byte of the register address, and the index number of the parameter in the group maps to the least significant byte. The control and status parameters of the drive are virtually taken as parameter group. The relationship of group number of the parameters and the most significant byte of register address is listed below:

F0 group: 0x00; F1 group: 0x01:

F2 group: 0x02; F3 group: 0x03;

F4 group: 0x04; F5 group: 0x05;

F6group: 0x06; F7 group: 0x07;

F8 group: 0x08; F9 group: 0x09;

FA group: 0x0A; Fb group: 0x0B;

FC group: 0x0C; Fd group: 0x0D;

FE group: 0x0E; FF group: 0x0F;

FH group: 0x10; FL group: 0x11;

Fn group: 0x12; FP group: 0x13;

FU group: 0x14;

Drive control parameter group: 0x32;

Drive status parameter group: 0x33.

E.g. the register address of F3.02: 0x302, register address of FF.01: 0xF01.

The above shows the format of the frame. Now we will introduce the Modbus function code and data unit for different function in details, which is called protocol data unit for simplicity. Also MSB stands for the most significant byte and LSB stands for the least significant byte for the same reason. The description below is data format in RTU mode. The length of data unit in ASCII mode should be doubled.

Protocol data unit format of reading parameters:

Request format:

Protocol data unit	Data length (bytes)	Range
Function code	1	0x03
Initial register address	2	0x0000~0xFFFF
Register number	2	0x0001~0x0004

Response format:

Protocol data unit	Data length (bytes)	Range
Function code	1	0x03
Number of bytes read out	1	2*Register Qty.
Contents	2*Register Qty.	

If the operation fails, error code and exception code forming the protocol data unit will be replied. The error code is (Parameter+0x80). The exception code denotes reason of the error; see the table below.

Table 1 Exception Code Meaning

Exception code	Meaning
0x1	Invalid parameter。
0x2	Invalid register address。
0x3	Data error, exceeding upper or lower limit
0x4	Drive operation failure, including invalid data, although within upper and lower limit.

Exception code	Meaning
0x5	Valid command, processing, mainly used in storing data into involatile memory.
0x6	Drive busy, please try later. Mainly used in storing data into involatile memory.
0x18	Information frame error, including data length or checksum error.
0x20	Parameter cannot be modified
0x22	Parameter protected by password.

Protocol data unit format of modifying single drive's parameter:

Request format:

Protocol data unit	Data length (bytes)	Range
Parameter	1	0x06
Register Address	2	0x0000~0xFFFF
Register content	2	0x0000~0xFFFF

Response format:

Protocol data unit	Data length (bytes)	Range
Parameter	1	0x06
Register Address	2	0x0000~0xFFFF
Register content	2	0x0000~0xFFFF

If the operation fails, error code and exception code will be replied. The error code is (Parameter+0x80). The exception code denotes reason of the error; see Table 1.

Protocol data unit format of serial line diagnosis:

Request format:

Protocol data unit	Data length (bytes)	Range
Function code	1	0x08
Sub-function code	2	0x0000~0x0030
Data	2	0x0000~0xFFFF

Response format:

Protocol data unit	Data length (bytes)	Range
Function code	1	0x08
Sub-function code	2	0x0000~0x0030
Data	2	0x0000~0xFFFF

If the operation fails, error code and message code will be replied. The error code is 88H. The exception code denotes reason of the error; see Table 1.

Sub-function of line diagnosis:

Sub-function code	Data (request)	Data (respond)	Meaning
0x0001	0x0000	0x0000	Initialize the communication, disable no-reply mode
	0xFF00	0xFF00	
0x0003	"new frame tail" and "00" occupy the MSB and LSB	"new frame tail" and "00" occupy the MSB and LSB	To set frame tail in ASCII mode. It will replace the old line feed character. It will not be saved upon power-off. Note: it must not be greater than 0x7F, nor equal to 0x3A.
0x0004	0x0000	No response	To set no-response mode, so the drive respond only to "initialize communication" request. It is to isolate the faulty drive.
0x0030	0x0000	0x0000	Drive not respond to error or invalid command
	0x0001	0x0001	Drive responds to error or invalid command

Protocol data unit format of modifying several drive's parameter and status parameters:

Request format:

Protocol data unit	Data length (byte)	Range
Function code	1	0x10
Initial register address	2	0x0000~0xFFFF
Register Qty.	2	0x0001~0x0004
Register bytes number	1	2* Register Qty.
Register contents	2* Register Qty.	

Response format:

Protocol data unit	Data length (byte)	Range
Function code	1	0x10
Initial Register Address	2	0x0000~0xFFFF
Register Qty.	2	0x0001~0x0004

Parameter 0x41 is to modify single drive's parameter or control parameter and save it in an involatile memory. The format is similar with that of 0x06. The only difference is that 0x41 parameter is saved upon power failure, while 0x06 not. Since some of the control parameters cannot be saved in the involatile memory, the two commands in this case have the same effect. Those parameters will be introduced later.

The management of parameters includes reading out the upper and lower limit of the parameters, parameters properties, max. index number of a parameter group, next or previous parameter group number, currently displayed status parameter index, or display the next status parameter. Parameter property includes R/W property, parameter unit, scaling, etc. These commands are helpful to provide information about parameter's range and properties etc which are necessary for modifying parameters remotely. The protocol data unit of parameter management is as follows:

Request format:

Protocol data unit	Data length(byte)	Range
Function code	1	0x42
Sub-function code	2	0x0000~0x0007
Data	2	It depends on drive's type

Response format:

Protocol data unit	Data length(byte)	Range
Function code	1	0x42
Sub-function code	2	0x0000~0x0007
Data	2	0x0000~0xFFFF

If the operation fails, error codes and exception code will be replied. The exception code is shown in Table 1.

Sub-function of parameter management

Sub-function code	Data (request)	Data (respond)	Meaning
0x0000	Parameter group number and index within a group occupy the MSB and LSB.	Upper limit of a parameter.	Read the upper limit of a parameter
0x0001	Parameter group number and index within a group occupy the MSB and LSB.	Lower limit of a parameter	Read the lower limit of a parameter
0x0002	Parameter group number and index within a group occupy the MSBand LSB.	Parameter property, see description below	Read out Parameter property
0x0003	Parameter group number occupies the MSB and the LSB is “00”.	Max. index within a parameter group	Read max. index within a parameter group
0x0004	Parameter group number occupies the MSB and the LSB is “00”.	Next parameter group number takes the higher byte and lower byte is “00”.”	Read next parameter group number
0x0005	Parameter group number occupies the MSB and the LSB is “00”.	Last Parameter group number occupies the MSB and the LSB is “00”.	Read previous parameter group number
0x0006	0x3300	Currently displayed status parameter index	Read currently displayed status parameter index
0x0007	0x3300	Next status parameter index	Display next status parameter

The status parameter group cannot be modified nor support upper or lower limit read-out operation.

Parameter property is 2 bytes in length. The definitions of its bits are as follows:

Parameter property (Bit)	Value	Meaning
Bit2~Bit0	000B	No decimal part
	010B	One digit of decimal
	011B	Two digits of decimal
	100	Three digits of decimal
	Others	Reserved
Bit3	Reserved	
Bit5~Bit4	00B	Modification step is “1”
	Others	Reserved
Bit7~Bit6	01B	Modifiable
	10B	Cannot be modified during running
	11B	Set by factory, cannot be modified
	00B	Actual parameters, cannot be modified
Bit11~Bit8	0000B	No unit
	0001B	Unit: Hz
	0010B	Unit: A
	0011B	Unit: V
	0100B	Unit: r/min
	0101B	Unit: m/s
	0110B	Unit: %
	Others	Reserved
Bit12	1	Upper limit is active every nibble
	0	Upper limit is active as a whole word
Bit15~Bit13	Reserved	

Drive control parameters cover the drive start/stop, frequency setting, etc. Through the status parameters, present frequency, output current, output torque, etc. can be retrieved. The control and status parameters are listed below:

Table 2 Drive’s Control Parameters Index

Register Address	Parameter name	Save upon power-off
0x3200	Control command word	No
0x3201	Main reference freq.	Y
0x3202	Reference Frequency	Y
0x3203	Digital close loop setting	Y
0x3204	Pulse close loop setting	Y
0x3205	Analog output AO1 setting	N
0x3206	Analog output AO2 setting	N
0x3207	Digital output DO setting	N
0x3208	Freq. proportion setting	N
0x3209	Virtual terminal control setting	N
0x320A	Acc time 1	Y
0x320B	Dec time 1	Y

Table 3 Inverter Status Parameters Index

Register Address	Parameter Name
0x3300	Operation status word 1
0x3301	Actual value of the current main setting
0x3302	Drive model
0x3303	Drive type
0x3304	Software version
0x3305	Present actual frequency
0x3306	Output current
0x3307	Output voltage
0x3308	Output power
0x3309	Actual rotating speed
0x330A	Actual line speed
0x330B	Analog close loop feedback
0x330C	Bus voltage
0x330D	External counter
0x330E	Output torque

Register Address	Parameter Name
0x330F	Digital value I/O terminal status: BIT0~14=X1~X8, Y1, Y2, TC, FAN, BRAKE, FWD, REV
0x3310	Actual length
0x3311	Frequency after compensation
0x3312	First fault in operation
0x3313	Second fault in operation
0x3314	Third fault (latest) in operation
0x3315	Frequency setting
0x3316	Rotation speed setting
0x3317	Analog close loop setting
0x3318	Line speed setting
0x3319	VCI
0x331A	CCI
0x331B	Preset length
0x331C	Preset Acc time 1
0x331D	Preset Dec time 1
0x331E	Command sending method: 0: Keypad 1: Terminal 2: Serial port
0x331F	Drive status word 2
0x3320	Frequency setting method: 0: digital setting 1, by ▲, ▼ key 1: digital setting 2, by UP/DN terminal 2: digital setting 3, serial port 3: VCI analog setting 4: CCI analog setting 5: terminal PULSE setting

Note: Drive (slave) model code principle: range: 0~9999, the thousand's and hundred's place denote drive series category, such as "TD" , "EV"; ten's and unit place for drive series, such as "1000", "2000" or "3100". For example, the model code of TDXXXX is: 0*1000+0*100+XXXX/100 model code of EVXXXX: 1*1000+0*100+XXXX/100; model code of PVXXXX: 1*1000+0*100+XXXX/100+1。

Bit Definition of Drive Control Word

Control word (bit)	Value	Meaning	Function
Bit2, 1, 0	111B	Operation command	Start the drive
	110B	Mode 0 stop	Stop as preset Dec time
	101B	Mode 1 stop	Coast to stop
	011B	Mode 2 stop	Reserved
	100B	External fault stop	Coast to stop. External fault message will be displayed
	Others	No command	
Bit3	1	Reverse	Running direction when operation command valid, invalid for jog operation
	0	Forward	
Bit4	1	Jog forward	
	0	Jog forward stop	
Bit5	1	Jog reverse	
	0	Jog reverse stop	
Bit6	1	Acc/Dec allowed	Reserved
	0	Acc/Dec prohibited	
Bit7	1	Serial port control valid	Current control word from serial port valid
	0	Serial port control invalid	Current control word from serial port invalid
Bit8	1	Main setting valid	Enable main setting
	0	Main setting invalid	Disable main setting
Bit9	1	Fault reset valid	
	0	Fault reset invalid	
Bit15~Bit10	000000B	Reserved	

Note: The jog operation setting (Bit4, Bit5) and Bit0~Bit2 must not be valid at the same time.

Bit Definition of Drive Status Word 1

Status word	Value	Meaning	Note
Bit0	1	Drive running	
	0	Drive stops	
Bit1	1	Drive reverse running	
	0	Drive forward running	
Bit2	1	Main setting arrived	
	0	Main setting not arrived	
Bit3	1	Communication control allowed	
	0	Communication control prohibited	
Bit7~4	0000B	Reserved	
Bit15~8	00~0xFF	Fault code	0:drive normal others: drive is faulty, see fault code in user manual. E.g., the fault code of motor overload is 0x0E,

Bit Definition of Drive Status Word 2

Status word (bit)	Value	Meaning
Bit0	1	Jog
	0	Non-jog
Bit1	1	Close loop running
	0	Non-close-loop running
Bit2	1	PLC running
	0	Non-PLC running
Bit3	1	MS running
	0	Non-MS running
Bit4	1	Simple running
	0	Non-simple running
Bit5	1	Traverse
	0	Non-traverse
Bit6	1	Undervoltage

Status word (bit)	Value	Meaning
	0	Non-undervoltage
Others		Reserved

5 Note

1. For data frame of ASCII format, if the length of the whole message is a even number, it will be discarded.

2. The communication will be interrupted during restoring to default parameters or auto-tuning, and resume to normal after them.

3. The parameter FH.09, FP.03 and FP.00 cannot be modified through communication. But FP.00 (password) can be verified through WRITE command.

4. If several multi-function terminals are set to the same function, error will occur. Please avoid it when modifying them using MODBUS protocol.

6 CRC Check

Considering the demand of increasing speed, CRC-16 uses form. The following are C language source code for realizing CRC-16 check. Note that the result has been exchanged MSB and LSB, i.e., it is the final CRC checksum to be sent out.

```
C language source code for calculating CRC checksum
unsigned short CRC16 ( unsigned char *msg, unsigned char length)      /* The function returns the CRC as a unsigned short type */
{
      unsigned char uchCRCHi = 0xFF ;                                 /* high byte of CRC initialized */
      unsigned char uchCRCLo = 0xFF ;                                 /* low byte of CRC initialized */
      unsigned uIndex ;                                               /* index into CRC lookup table */
      while (length--)                                                /* pass through message buffer */
      {
            uIndex = uchCRCLo ^ *msg++ ;                              /* calculate the CRC */
            uchCRCLo = uchCRCHi ^ (crcvalue[uIndex] >>8);
            uchCRCHi =crcvalue[uIndex]&0xff;
       }
       return (uchCRCHi | uchCRCLo<<8) ;
}
                                                                      /* Table of CRC values */
const unsigned int    crcvalue[ ] = {
0x0000,0xC1C0,0x81C1,0x4001,0x01C3,0xC003,0x8002,0x41C2,0x01C6,0xC006,0x8007,0x41C7,
0x0005,0xC1C5,0x81C4,0x4004,0x01CC,0xC00C,0x800D,0x41CD,0x000F,0xC1CF,0x81CE,0x400E,
0x000A,0xC1CA,0x81CB,0x400B,0x01C9,0xC009,0x8008,0x41C8,0x01D8,0xC018,0x8019,0x41D9,
0x001B,0xC1DB,0x81DA,0x401A,0x001E,0xC1DE,0x81DF,0x401F,0x01DD,0xC01D,0x801C,0x41DC,
0x0014,0xC1D4,0x81D5,0x4015,0x01D7,0xC017,0x8016,0x41D6,0x01D2,0xC012,0x8013,0x41D3,
0x0011,0xC1D1,0x81D0,0x4010,0x01F0,0xC030,0x8031,0x41F1,0x0033,0xC1F3,0x81F2,0x4032,
0x0036,0xC1F6,0x81F7,0x4037,0x01F5,0xC035,0x8034,0x41F4,0x003C,0xC1FC,0x81FD,0x403D,
0x01FF,0xC03F,0x803E,0x41FE,0x01FA,0xC03A,0x803B,0x41FB,0x0039,0xC1F9,0x81F8,0x4038,
0x0028,0xC1E8,0x81E9,0x4029,0x01EB,0xC02B,0x802A,0x41EA,0x01EE,0xC02E,0x802F,0x41EF,
0x002D,0xC1ED,0x81EC,0x402C,0x01E4,0xC024,0x8025,0x41E5,0x0027,0xC1E7,0x81E6,0x4026,
0x0022,0xC1E2,0x81E3,0x4023,0x01E1,0xC021,0x8020,0x41E0,0x01A0,0xC060,0x8061,0x41A1,
0x0063,0xC1A3,0x81A2,0x4062,0x0066,0xC1A6,0x81A7,0x4067,0x01A5,0xC065,0x8064,0x41A4,
0x006C,0xC1AC,0x81AD,0x406D,0x01AF,0xC06F,0x806E,0x41AE,0x01AA,0xC06A,0x806B,0x41AB,
0x0069,0xC1A9,0x81A8,0x4068,0x0078,0xC1B8,0x81B9,0x4079,0x01BB,0xC07B,0x807A,0x41BA,
0x01BE,0xC07E,0x807F,0x41BF,0x007D,0xC1BD,0x81BC,0x407C,0x01B4,0xC074,0x8075,0x41B5,
0x0077,0xC1B7,0x81B6,0x4076,0x0072,0xC1B2,0x81B3,0x4073,0x01B1,0xC071,0x8070,0x41B0,
0x0050,0xC190,0x8191,0x4051,0x0193,0xC053,0x8052,0x4192,0x0196,0xC056,0x8057,0x4197,
0x0055,0xC195,0x8194,0x4054,0x019C,0xC05C,0x805D,0x419D,0x005F,0xC19F,0x819E,0x405E,
0x005A,0xC19A,0x819B,0x405B,0x0199,0xC059,0x8058,0x4198,0x0188,0xC048,0x8049,0x4189,
0x004B,0xC18B,0x818A,0x404A,0x004E,0xC18E,0x818F,0x404F,0x018D,0xC04D,0x804C,0x418C,
0x0044,0xC184,0x8185,0x4045,0x0187,0xC047,0x8046,0x4186,0x0182,0xC042,0x8043,0x4183,
0x0041,0xC181,0x8180,0x4040}
```

If calculating the CRC Checksum of all the sent characters, it may take long time. It can nevertheless save the space occupied by form. The routine for calculating CRC on line is as follows:

```
unsigned int crc_check(unsigned char *data,unsigned char length)
{
    int i;
    unsigned crc_result=0xffff;
 while(length--)
{
    crc_result^=*data++;
        for(i=0;i<8;i++)
    {
         if(crc_result&0x01)
                crc_result=(crc_result>>1)^0xa001;
        else
                crc_result=crc_result>>1;
    }
}
return (crc_result=((crc_result&0xff)<<8)|(crc_result>>8));
}

}
```

7 Application

The command of starting 5# drive, running forward, 50.00Hz (write as 5000 in the command):

	Address	Function code	Initial register address	Quantity of registers	Bytes of registers content	Content of registers	Checksum
Request	0x05	0x10	0x3200	0x0002	0x04	0x01C7,0x1388	0x16A9
Response	0x05	0x10	0x3200	0x0002	none	none	0x4EF4

5# drive jog:

	Address	Parameter	Register Address	Register Content	Check sum
Request	0x05	0x06	0x3200	0x00D0	0x876A
Response	0x05	0x06	0x3200	0x00D0	0x876A

5# drive stop jog:

	Address	Parameter	Register Address	Register Content	Check sum
Request	0x05	0x06	0x3200	0x00C0	0x86A6
Response	0x05	0x06	0x3200	0x00C0	0x86A6

5# drive reset:

	Address	Parameter	Register Address	Register Content	Check sum
Request	0x05	0x06	0x3200	0x0180	0x86C6
Response	0x05	0x06	0x3200	0x0180	0x86C6

Read 5# drive current frequency, the reply is 50.00Hz:

	Address	Parameter	Register Address	Register Qty or bytes	Register Content	Check sum
Request	0x05	0x03	0x3301	0x0001	None	0xDB0A
Response	0x05	0x03	None	0x02	0x1388	0x44D2

Modify 5# drive Acc time 1 (Parameter F0.10) to 10.0s, not save upon power-off.

	Address	Parameter	Register Address	Register Content	Check sum
Request	0x05	0x06	0x000A	0x0064	0xA9A7
Response	0x05	0x06	0x000A	0x0064	0xA9A7

Read 5# drive output current, the replay is 30.0A.

	Address	Parameter	Register Address	Register Qty or bytes	Register Content	Check sum
Request	0x05	0x03	0x3306	0x0001	None	0x6ACB
Response	0x05	0x03	None	0x02	0x12C	0x49C9

Read 5# drive Dec time (F0.11), the replay is 6.0S.

	Add.	Para.	Register Add.	Register Qty or bytes	Register Content	Check sum
Request	0x05	0x03	0x000B	0x0001	None	0xF4C4
Response	0x05	0x03	None	0x02	0x003C	0x4995

8 Scaling

1. Frequency scaling: 1:100

If the drive is expected to run at 50Hz, the main setting should be 0x1388 (5000).

2. Time scaling: 1:10

If the drive acceleration time is expected to be 30S, the parameter should be set at 0x012c (300).

3. Current scaling: 1:10

If the feedback current is 0x012c, the present current is 30A.

4. The output power is an absolute value

5. Others, such as terminal input or output, please refer to user manual.

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Maintenance Record (1)

Customer's company:	
Address:	
Post Code:	Contact person:
Tel:	Fax:
Drive's SN:	
Power:	Drive's model:
Contract number:	Purchasing Date:
Service provider:	
Contact person:	Tel:
Servicing engineer:	Tel:
Maintenance date:	
Customer's comments on service quality: ☐**Excellent** ☐**Satisfactory** ☐ **Acceptable** ☐**Unsatisfactory** Other Opinions: Signature: DD MM YYYY	
Visiting Record of Customer Service Center: ☐**by phone-calls** ☐**by questionnaire** Others: Signature: DD MM YYYY(date)	

Note: This paper becomes invalid if the user cannot be revisited!

Emerson Network Power Co. Ltd.

Maintenance Record (2)

Customer's company:	
Address:	
Post Code:	Contact person:
Tel:	Fax:
Drive's SN:	
Power:	Drive's model:
Contract number:	Purchasing Date:
Service provider:	
Contact person:	Tel:
Servicing engineer:	Tel:
Maintenance date:	
Customer's comments on service quality: ☐**Excellent** ☐**Satisfactory** ☐ **Acceptable** ☐**Unsatisfactory** Other Opinions: Signature: DD MM YYYY	
Visiting Record of Customer Service Center: ☐**by phone-calls** ☐**by questionnaire** Others: Signature: DD MM YYYY(date)	

Note: This paper becomes invalid if the user cannot be revisited!

Notice

1. The warranty range is confined to the drive only.

2. **Warranty period is 18 months**, within which period Emerson Network Power conducts free maintenance and repairing to the drive that has any fault or damage under the normal operation conditions.

3. **The start time of warranty period is the delivery date of the product**, of which the product SN is the sole basis of judgment. Drives without a product SN shall be regarded as out of warranty.

4. Even within 18 months, maintenance will also be charged in the following situations:

- Damages incurred to the drive due to mis-operations, which are not in compliance with the User Manual;
- Damages incurred to the drive due to fire, flood, abnormal voltage, etc;
- Damages incurred to the drive due to the improper use of drive functions.

5.The service fee will be charged according to the actual costs. If there is any contract, the contract prevails.

6.Please keep this paper and show this paper to the maintenance unit when the product needs to be repaired.

7. If you have any question, please contact the distributor or our company directly.

ENP Services China

Emerson Network Power Co., Ltd.

Address: No.1 Kefa Rd., Science & Industry Park, Nanshan District, 518057, Shenzhen, PRC

Customer Service Hotline: +86 755 86010581

Complaint Hotline: +86 755 86010800

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To Customers:

Thank you for choosing our products. We are expecting your comments about the quality of the products, so that we can improve our work and serve you better. We really appreciate if you would fill in the form after the product has operated for 1 month, and then mail or fax it to the Customer Service Center of Emerson Network Power. We will send you an exquisite souvenir upon the receipt of the completed Product Quality Feedback Paper. You will receive a special gift if you can give us any advices on improving the product and service quality.

Customer Service Dept

Emerson Network Power Co., Ltd.

Product Quality Feedback Form

User's name		Tel:	
Address		Post code	
Product model		Installation date	
Product SN			
Product outline or structure			
Product performance			
Product package			
Product manual			
Product quality condition in using			
Your advices on product improvement			

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